THE IMPACT OF PUBLISHED EXPECTATIONS OF U.S.D.A. CATTLE ON FEED REPORT NUMBERS ON LIVE CATTLE FUTURES MARKETS

by

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B.S., Kansas State University, 1986

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Agricultural Economics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1987

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Acknowledgements

I would like to take this opportunity to thank the Graduate School and Department of Agricultural Economics for their financial support of my graduate study at Kansas State University.

I would also like to thank my graduate committee for their guidance and assistance with my graduate program. Dr. Mark McNulty also deserves recognition for his invaluable efforts and recommendations in my statistical analysis. I would like to express special appreciation to Dr. Orlen Grunewald, whose time, patience, and understanding allowed me to sucessfully meet my goals over the past year.

A final thank you is extended to all of my family members whose love and support were greatly appreciated. Especially to my parents, Elaine and Bill Conway, who taught me how to achieve lofty goals while maintaining a proper perspective. And finally, I would like to thank my fiancee Melissa, for her undying love and understanding during the preparation of this thesis.

Chapter I

Introduction

Problem Statement

There appears to be a general discontent among livestock producers with cattle futures trading and practices occurring in the livestock markets recently. Many producers think that the futures markets react too violently and erratically to new market information. Such price reactions can have an adverse impact on the cash price that cattlemen are paying and/or receiving for their cattle at present and in future periods. The price adjustment is basically a function of how well the information is simultaneously transferred to the futures and cash markets. New market information can have a profound effect on cash cattle prices as they in turn react to changing fundamentals.

Producers believe the volatile price swings are not rational reflections of value. They believe that underlying fundamental supply and demand parameters do not change radically on a day to day basis. Thus, cattle prices should adjust in short, small increments, not in the extremely volatile manner which they are now experiencing. This problem has caused many producer groups such as state cattle producer organizations and the

National Cattleman's Association to call for serious review or even discontinuance of cattle futures trading (Crowley 1987; Chicago Mercantile Exchange 1986; Chicago Mercantile Exchange 1987).

One major source of information which contributes to this perceived problem is the monthly U.S.D.A. Cattle on Feed Report. Producers are concerned about the price responses occurring around report release dates. Each month the U.S.D.A. issues estimates of major supply factors concerning cattle numbers in the United States. The published numbers are used by the livestock trade as a basis for determining future market supplies of cattle and beef. The U.S.D.A. publishs a marketings and placements figure for the previous month, and a total cattle on feed estimate for the first day of the month the report is released. All three figures are reported as percentages of the previous year's numbers. These numbers are important in forming expectations. Thus, prices will adjust quickly to the new information introduced through the changes in expectations. Such price adjustments can be large in magnitude, with limit moves occurring several days in sucession.(1) The adjustments can also occur in the opposite direction of what generally would be

(1) The Chicago Mercantile Exchange establishes a daily trading limit of $1.50 above or below the previous day's settlement on cattle futures contracts.

anticipated, given only the report information.

An example of a volatile market price reaction occurred after the Cattle on Feed Report released May 15, 1986. The report numbers were all considered to be bearish in relation to traders' anticipations. A bearish report would be characterized by a high placements figure, a low marketings figure and a high cattle on feed estimate, all relative to expectations. The May 1986 Report contained high onfeed and placements numbers and a low marketings figure relative to published pre-release expectations. Futures traders interpreted the report bearishly, and cattle futures settled limit down the first trading day following the report. Futures declined nearly four dollars within four days and cash prices dropped nearly two dollars in the same period. This is an example of why producers have called for an investigation into livestock futures trading.

Objectives

The research reported here was designed to satisfy several objectives which have been identified through consideration of the previous discussion. The first objective was to determine what are the actual expectations of traders at the time the U.S.D.A. releases the Cattle on Feed Report. Specifically, this research was

designed to measure the extent published Cattle on Feed Pre-Release Estimates are used by cattle futures traders. The analysis was also designed to determine if price volatility surrounding the reports is due to the relationship between report numbers and the estimates. The results could then be used to explain the impact these expectations and resulting adjustments have on the futures markets for cattle. Finally, a model was formulated which could accurately predict price changes following the reports as some function of the Cattle on Feed numbers.

The pre-release estimates are industry forecasts of the three U.S.D.A. figures. These are published for the public by Commodity News Services (C.N.S.) two business days before the report release. There are approximately 25 firms and individuals who contribute their estimates monthly for the seven state reports and quarterly for thirteen state reports. Some livestock organizations have requested that C.N.S. discontinue publishing the pre-release estimates (Brundrett 1985). They are claiming that futures markets place too much emphasis on these numbers and prices react too strongly to the estimates.

Actual expectations should be similar to the estimates, if the sample is representative of the market agents determining price. If the sample is not representative, the market supply expectation may be quite

different than the published estimates. After the supply expectation was determined, the effects of the pre-release estimates and Cattle on Feed Reports were more easily analyzed. The U.S.D.A. numbers can be interpreted as either bullish, bearish, or neutral relative to actual supply expectations. Therefore, the true information content should be obvious shortly after a Cattle on Feed Report is released. This information can be used by cattle traders to assess the Report implications. Their assessment allows them to initiate positions based on actual pre-report expectations and resulting U.S.D.A. supply information.

The objective involving market price reactions is designed for traders to use to forecast price changes following Cattle on Feed Reports. When Cattle on Feed numbers are different from expectations, prices should adjust quickly to the new information. Similarily, when Cattle on Feed numbers are not significantly different from expectations, large price changes are not expected based on the new information. This knowledge makes it possible to accurately assess price fluctuations following Cattle on Feed Reports. The empirical relationship proves price volatility associated with reports is either unwarranted, as the producer groups claim, or economically rational based on new information. Future price

implications can also be analyzed under this framework.

This research has produced some useful results that will benefit cattle producers and traders. The results can be used by cattle market participants in forecasting and planning their hedging strategies. Therefore, the producers and processors subject to adverse price risk are better able to protect themselves from market price volatility.

Hypotheses

Five hypotheses have been identified which are researchable in regards to Cattle on Feed Pre-Release Estimates, Cattle on Feed Reports, and market price reactions. Accurate answers to these hypotheses yielding new information can be of benefit to the livestock industry. The five research hypotheses are as follows.

1) C.N.S. Cattle on Feed Pre-Release Estimates as measured by the analysts average is a rational reflection of market expectations concerning the supply of cattle.

2) Futures price reactions following a Cattle on Feed Report are directly related to the differences in pre-report average estimates and the U.S.D.A. numbers.

3) A subgroup of analysts consistently outperform the population surveyed by Commodity News Services in their predictions of U.S.D.A. Cattle on Feed numbers.

4) A different pre-release estimate can be formulated which will be a better estimate of true supply expectations held by market participants.

5) A model can be developed which will predict price changes following Cattle on Feed Reports, based on the numbers contained in the Report.

Analysis of these hypotheses determines how much, if at all, traders use the pre-release estimates in forming price expectations. A fairly reliable estimate of market anticipations before the release of U.S.D.A. Cattle on Feed Reports was identified.

Note on the Data

The pre-release estimates published by C.N.S. contain individual estimates for approximately 25 analysts and a simple average, calculated with the high and low estimates removed. These data were difficult to obtain, as the estimates were not consistently reported until the early 1980's. The data base used in this study consists of 108 observations of the average estimates; however, the analysts' estimates were not available for all of these reports. Individual estimates ranged from 20 to 59 observations. The quarterly and monthly estimates were pooled when analyzing the role of individual estimates. This was necessary to insure that were enough observations

to make the analysis statistically meaningful. Data were Pooled by combining two monthly Cattle on Feed Reports followed by a quarterly Cattle on Feed Report for the period encompassing February 1977 through December 1986. However, there were some missing monthly estimates during the early years. The data set was also split into two data sets, one including quarterly reports (36 quarters from 1977 I - 1986 IV), and the other monthly reports (40 months from September 1983 - December 1986). These data sets were used in some of the regressions and in all correlation testing.

There is no problem with pooling these estimates, as they are essentially a sample measurement of the same empirical observations. The only differences are that the quarterlies are covering more states and a longer time period. However, the data are all expressed in percentages of year earlier figures to remove seasonal distortions. The data sets used for specific statistical tests will be mentioned whenever they are referenced.

Live Cattle Markets - Supply

Live Cattle are agricultural commodities which are traded as homogeneous products in large public markets. The majority of U.S. livestock is traded in major public markets and cattle are priced as possessing homogeneous

characteristics. Definite exceptions exist, such as purebred animals used in breeding herds. However, these are different types of markets than the futures markets analyzed here, and thus can be disregarded. Large volume livestock trading uses pricing schedules for specific characteristics of individual animals, but these discounts and premiums are all based on a generic homogenous commodity. For example, the Chicago Mercantile Exchange specifies in its Live Cattle Futures contract that deliverable animals must be "U.S.D.A. yield grade 1,2,3, or 4, Choice quality grade live steers, averaging between 1050 pounds and 1200 pounds with no individual steer weighing more than 100 pounds above or below the average weight for the unit" (Chicago Mercantile Exchange 1982). A deliverable animal or par delivery unit is the commodity which the individual exchange will accept in fulfilling the requirements of the particular futures contract. There are no requirements of breed, sex, color, height or many other characteristics in this par delivery unit. However, premium and discount schedules are specified for certain quality deviations. The major point in this example is that the animals are traded as commodities and not as individual heterogeneous products in large scale livestock trade.

Cattle traders base their beef and cattle supply

forecasts almost entirely on their interpretation of U.S.D.A. Cattle on Feed Reports. Other supply information exists in the markets, but it is not as throughly researched as the U.S.D.A. numbers and thus is not perceived to be as accurate. Therefore, there is little chance that this information could be obtained and used privately to garner excess profits when trading in the cattle markets. The government's role in producing Cattle on Feed numbers for public use greatly diminishes any opportunities to trade cattle on "private or privileged information."

Live Cattle Markets - Demand

The demand parameters and changes in demand are not as easily identifiable as the supply side of the cattle markets. Aggregate consumer demand for red meat changes, but in such a slow manner that the change is gradually internalized into price over a period of many years. No excess profits can be made through private information concerning consumer preferences, due to the extremely slow nature of the information availability. The only private information which exists in this market would be packers' buying intentions for the future. However, there is enough competition in this industry that changes made by one firm will be compensated by other

firms, and the market effect would be too minimal to yield excess profit opportunities.

U.S.D.A. Cattle on Feed Reports

The U.S.D.A. Crop Reporting Board is the group which is responsible for gathering, researching and analyzing the information which is released in the monthly and quarterly Cattle on Feed Reports. The Board takes a monthly survey of the seven largest cattle producing states and releases a total cattle on feed number for the first of the month in which the report is released. Placements of cattle on feed and marketings of cattle during the previous month are also released at this time. These three numbers are presented as a percentage of the same figures for the period one year earlier. This is due to seasonal differences in cattle production which would make the raw data difficult to interpret. This same procedure is also conducted on a quarterly basis for the thirteen largest producing states. The quarterly numbers were changed from 23 states to thirteen states in 1981. The quarterly reports are released in January, April, July and October.

The Crop Reporting Board (C.R.B) assembles supply figures for many of the major agricultural commodities as well as cattle. The procedure used in all of their

reports is very similar. The data are collected at the state level, by regional statistical offices, and then it is sent to the C.R.B. office in Washington. It is then assembled, compiled and analyzed under extremely secure conditions to prevent any premature leakage. These sessions are known as "lock outs." The information is aggregated into regional and national numbers, and is then referenced against other data, such as commercial slaughter (Spilka 1983). After the C.R.B. confirms the accuracy of the data, it releases the information to the public at a news conference after the daily markets have closed. The secure manner in which these data are produced does not allow private individuals to benefit from insider information. This procedure enhances the pricing efficiency of the cattle markets.

Review of Procedures used in this Research

This research began with gathering the necessary data and relevant literature concerning the proposed hypotheses to be studied. The literature review consisted of identifying and analyzing the available published research concerning four subject areas relevant to this study. The four areas of concentration were: 1) Cattle Market Efficiency; 2) Empirical studies of expectations data; 3) Market Effects of U.S.D.A. Commodity Reports; and 4)

Theory of Rational Expectations.

The basic theory underlying this research is the theory of rational expectations. Several books and economic publications were studied to develop a basic knowledge and understanding of the theory. This theory was then analyzed relative to the specific research to help in applying the proper statistical techniques which would reflect the intended results. Different statistical and econometric techniques ranging from simple T-tests to advanced regression analysis were conducted on the hypotheses, depending on the particular analytical requirement.

After each hypothesis was tested statistically, the results were promptly analyzed and conclusions formed before continuing on to the next hypothesis. By analyzing the data at this point, preliminary conclusions were formed while the analysis was relatively new and fresh. After all of the hypotheses were analyzed, the overall objectives were incorporated with the preliminary conclusions to form the final results. The main conlusions and implications of this study were then formally added to the manuscript.

Chapter II

Literature Review

The research conducted in this study is original, but it also is closely related to several areas of interest where published research exists. No available studies were found in this literature review which directly analyzed the impact of Cattle on Feed Pre-Report Estimates. However, four general subjects have been researched in the past which have direct implications to this specific analysis. The four subject areas are:

1) Cattle Market Efficiency
2) Empirical Studies of Expectations Data
3) Market Effects of U.S.D.A. Commodity Reports
4) Theory of Rational Expectations

The literature review conducted for this research concentrated basically on these four areas of published studies. Other topics were considered, such as cash and futures price relationships, but these were found to be of little interest or relevance to the specific nature of this research. These four areas are reviewed seperately throughout the rest of this chapter.

Cattle Market Efficiency

Several studies have been conducted analyzing the efficiency of the livestock futures markets in general and the cattle futures market specifically. The objectives of these studies were generally similar in nature. Most of these research articles were trying to specifically determine the relative efficiency of the hog and/or cattle futures markets. The efficiency issue is difficult to accurately quantify, and the research conducted so far is is not conclusive, as well as contradictory between different studies.

Market Tests of Efficiency

The concept of market efficiency can be described as a market's ability to incorporate all information into price. The pioneer work done in the area of market efficiency has primarily focused on the large public stock and bond markets. Fama et al. (1965, 1966, 1969) analyzed the efficiency of the stock market in several publications appearing in the late 1960's. These studies have served as the basis for nearly all market efficiency research since their publication. Their article entitled "The Adjustment of Stock Prices to New Information," is the most relevant article to this research (Fama et al., 1969).

These researchers analyzed 940 stock splits involving over 622 New York Stock Exchange securities from January, 1927 through December, 1959. They analyzed a simple model expressing a linear relationship between the monthly rates of return provided by an individual security and general market conditions. The results of their research allowed the analysts to conclude that the stock market is "efficient," in the sense that stock prices adjust very rapidly to new information. These findings can be used as a framework for reviewing literature concerning the efficiency of cattle futures markets.

Many similar or related studies have been conducted regarding the efficiency issue in the capital markets. Most of these studies served as basic models for researchers analyzing livestock futures efficiency. Much of the original work analyzed the Random Walk Theory. Fama et al. (1965, 1966) published two studies covering the stock markets and Random Walk Price Theory. S. A. Alexander (1961, 1964) also published two articles in the early 1960's on Random Walks in speculative markets. Thus, there is a wide body of previous research in this area which is at the disposal of researchers in the cattle futures markets.

The cattle futures efficiency issue is important in analyzing the effect of Pre-Release Estimates and Cattle

on Feed Reports. The markets must be considered efficient to correctly assess market anticipations and changes in information. If the markets are not efficient, then the analysis of their ability to incorporate new information would be suspect.

Futures Prices as Predictors of Cash Prices

One common method of analyzing market rationality has been to research the ability of futures prices to accurately predict the spot cash prices. The basic hypothesis is that if futures prices accurately predict cash prices, then they are rational reflections of value. Most of the research has simply modelled cash prices as a function of futures prices. Testing that the intercept is equal to zero and the coefficient is equal to one, indicates that the futures price is an unbiased forecaster of spot cash prices. This method is similar to the methodology in this study used to analyze the rationality of the average estimates as predictors of the U.S.D.A. figures.

Raymond M. Leuthold has done some of the most significant work in analyzing cattle futures markets. Leuthold (1974), first revealed his findings on the cattle futures markets in his article entitled, "Random Walk and Price Trends: The Live Cattle Futures Market". The

objective of his study was to analyze the efficiency of the cattle futures market in forward pricing. The model used by Leuthold is similar to the one used in the study reported here, except that his model used prices and not quantity variables. The specific model used in Leuthold's research is:

$$FPt = A + B*FPt-i$$

where: FPt = the closing futures price for a contract at delivery, and

FPt-i = the futures price for the ith month before maturity.

Leuthold conducted the same analysis used in the study reported here to test whether the intercept (A), was equal to 0 and the coefficient (B), was equal to 1. Rejection of this test would have indicated that futures prices were not good predictors of cash prices. Leuthold tested 36 live cattle futures contracts, and 35 corn futures contracts for comparison. He concluded that futures prices for live beef cattle estimate subsequent spot prices as efficiently as do corn futures prices. This was somewhat surprising, considering the differences in the two commodities regarding storability. He also concluded that futures prices become less and less efficient relative to the cash price estimates as futures contract length of maturity increases. Leuthold's results

are somewhat inconsistent with prior studies, but they generally bode well with the contention that the cattle futures markets are relatively efficient.

Leuthold has also performed other empirical tests regarding the efficiency of livestock futures markets. Leuthold and Hartmann (1979) published the results of a hog market efficiency study in an article entitled "A Semi-Strong Form Evaluation of the Efficiency of the Hog Futures Market." The study compared an econometric model versus the futures price as a predictor of cash prices. Leuthold and Hartmann concluded that on occasion the live-hog futures market did not perform efficiently during the time period studied. Thus, the futures market had not at all times reflected all the available information. These results cause concern with regards to the research done here. Although the hog futures and the cattle futures markets have some specific differences due to commodity characteristics etc., there is enough similarity in the two markets to question the cattle futures' efficiency. No tests have been performed similar to this on the cattle futures market.

Martin and Garcia (1978) reported their research which extended much of Leuthold's work in the area of efficiency and price forecasting in livestock futures markets. Martin and Garcia found that the performance of

live cattle futures as forecasts of cash prices did not improve over the seven years following Leuthold's study. Further, they found that live cattle futures have been reliable forecasts during rising prices, but less reliable during price declines. They carried this analysis even further and concluded that livestock futures were better forecasters during stable economic times than during periods of instability. Just and Rausser (1981) conducted research on several agricultural commodities under this framework and also formed similar conclusions regarding the cattle market.

Shonkwiler (1986) analyzed an issue similar to the efficiency concept. His research analyzed the question, "Are Livestock Futures Prices Rational Forecasts?" This concept relates directly to Muth's claim that all available information be taken into account when market participants make decisions. His results indicated from recent data that the livestock futures markets are ignoring certain types of information. The analysis assumed that the relevant market structures were stable and does not account for evolving structure. He claims that this restriction diminishes the value of imposing economically rational expectations.

Kolb and Gay (1983) also analyzed the ability of live cattle futures to predict subsequent spot prices. Their

research was performed in a direct criticism of Helmuth (1981), who found that the cattle futures markets exhibited a systematic, predictable downward bias. A test was performed on the regression equations to determine if the slope and intercept were equal to zero. If the futures prices are good predictors, this hypothesis will not be rejected. The results were fully consistent with the hypothesis that futures prices accurately predict spot cash prices. Kolb and Gay conclude "the performance of the market appears to be exemplary in all respects analyzed."

Other Tests of Market Efficiency

Koppenhaver (1983), continued the work of Leuthold; Just and Rausser; and Martin and Garcia with the addition of several changes. In particular, Koppenhaver believed that since systematic bias is present in the futures prices, then this information should be used to create accurate price expectations using futures quotes. He states, "that unbiasedness is not a property required for prices to fully reflect available information at one point in time."

Koppenhaver analyzed a more general stochastic process for describing price behavior. The submartingale procedure includes the random walk model as a special case

and allows for the presence of nonnegative risk premiums in determining price. Given the results of previous studies, he felt the cattle futures market was an excellent market to study using this process. His model added variables for the influence of the risk premium and a lagged information set. Expected price changes would be nonnegative and trading on the information set would not yield better results than a buy and hold strategy. A test of nonnegativity will determine the weak form of efficiency. If the information set holds other publicly known information, then the semistrong form can be tested. Finally, if the information set includes all available information, then the strong form of efficiency can be tested.

The analysis found the live cattle futures market to be weak form efficient at contract maturities of one, two, four, and six months. These were determined using the submartingale price model described above. Weak form inefficiency during months three and five were attributed to lack of producer hedging during those time periods. The market prices were found to be semistrong efficient only at the one month maturity level. This is conditional on the information subset used, which was past spot hog prices and cattle on feed numbers. Koppenhaver concludes that information sets exist that would support the

semistrong form for all the maturities analyzed.

Koppenhaver's conclusions have direct implications for the objectives of this research. Part of the analysis done here is to determine what role the Cattle on Feed Pre-Release Estimates and the Reports have on the market. The research hypothesizes that these numbers are included in the information set to which Koppenhaver alludes.

Barton and Tomek (1984) also analyzed the performance of the live cattle futures contract relative to the basis and forward pricing behavior. They criticized previous work done by Leuthold and others for regressing pooled closing futures prices on monthly futures prices for eight lagged periods. Their analysis identified three problems with this aggregation, and attempted to correct for these in their model. They also tried to correct for a contemporaneous covariance problem which they identified.

The basis work which they analyzed has no relevant influence on the research being done here. The results of their pricing efficiency work show that the cattle markets appear to be weakly efficient. They believe effective determination of weak form market efficiency requires the use of unrelated regression techniques. These should be run on individual equations for disaggregated observations. However, there are often too few degrees of freedom for this method of analysis. They believe further

tests of the semistrong form might be more appropriate given the problems associated with the weak form.

Empirical Studies of Expectations Data

Direct tests of Rational Expectations, market efficiency and the ability of markets to utilize information are difficult to perform without actual observations of forecasts. Empirical forecasts are difficult to observe and subsequently analyze for rationality, since data series are not widely available. This type of analysis is very close to what the research reported here is attempting to do. However, there are a few published series of forecasts available for research, especially in the macroeconomic field. The most widely used data concerning economic forecasts is from the survey conducted by Joseph A. Livingston of the "Philadelphia Bulletin."

Research on the Livingston Macroeconomic Forecasts

Extensive empirical analysis has been conducted on the accuracy and rationality of the macroeconomic forecasts included in the Livingston survey. Joseph A. Livingston, an economic columnist, has surveyed leading macroeconomists and published their forecasts twice a year

since July 1, 1946. The forecasts include variables such as wages, prices, industrial stock prices, real and nominal G.N.P. and many other expectations. The availability of forty years worth of forecasts has produced many journal articles analyzing their accuracy and rationality. Economists such as (Turnovsky and Wacheter (1970); Gibson (1972); Wachtel (1974); and several others have researched the wage and price forecasts extensively. Recent research using the Livingston data examined ten of these variables and was published by Brown and Maital (1981).

The Brown and Maital study is a widely accepted research analysis and serves as the framework for the methodology of this study. Brown and Maital attempted to prove that the economists' expectations were fully rational. They first indirectly tested all of the forecasts for partial rationality by detecting the presence or absence of bias. The study also accounted more carefully for the serial correlation problem than previous studies. Serial correlation exists because the realized values are not known when the prediction is made, and thus the corresponding future forecast errors are not observable.

The researchers first analyzed the data for partial rationality, which indicates that the prediction is an

unbiased predictor of the actual value over time. This involved calculating a simple one variable regression of the actual values as a function of the predicted values. The hypothesis that the intercept was equal to zero and the slope simultaneously equalled one was tested. Rejection of this led to the conclusion that a particular expectation was biased and therefore was not partially rational.

The forecasts were then tested for the property of full rationality. Full rationality implies that a particular forecast has used all the available information in an optimal manner. This concept was indirectly tested through statistical regression analysis. The forecast errors were regressed as functions of known values in the past. If any such variables display significant coefficients, then the information was not incorporated in the forecast. This would indicate that the information had been ignored and thus the expectation would be considered irrational.

Brown and Maital analyzed the expectations from 1961 through 1977 for both bias and completeness. They found an absence of bias for six and twelve month forecasts as a rule. Thus the hypothesis of partial rationality could not be rejected. However, the tests for completeness found significant coefficients for some of the lagged

variables. Therefore they rejected the hypothesis of fully rational expectations in a majority of the cases studied.

An earlier study by Pesando (1975), examined the Livingston price expectations for rationality, in the sense of John F. Muth. His hypothesis is similar to the one analyzed in the research reported here. Pesando claimed expectations that did not possess the characteristics of rationality, were not accurate representations of the market's anticipations. Pesando researched the Livingston forecasts of inflation. He first expressed the multiperiod forecasts as a geometric average of a series of corresponding one-period forecasts. This form allowed him to directly test for rationality.

Pesando tested only the weak form of efficiency for these expecations as he modelled observed inflation rates as a function of a series of past rates. The null hypothesis test for rationality was that the coefficients were all equal. The results indicated that the null hypothesis of rationality is rejected at the one percent significance level. He concluded this largely to be due to a consistency requirement. However, he found that the one-period forecasts are efficient in utilizing the information contained in the realized inflation rates.

Mishkin (1981) analyzed the Livingston price forecast data in response to Pesando's findings. Mishkin also analyzed interest rate forecasts in the bond market in response to a study done by Friedman (1980). Friedman found the bond market forecasts to be irrational, much like Pesando concluded on the Livingston inflation forecasts. Mishkin used actual price data to infer market expectations and determine the rationality of the bond market. He estimated two regression equations modelling the forecasted variables. E(Xt) is the one-period-ahead forecast of a variable (Xt), generated at the end of period t-1. Regression equations were calculated for E(Xt) and (Xt). The null hypothesis was that Bi = Ci for all i, where Bi and Ci are the respective coefficients for (Xt) and E(Xt). The coefficients should be equal under the hypothesis of rational expectations. He measured this with conventional F-tests.

Mishkin scrutinized both Friedman's and Pesando's results in this study using likelihood ratio statistics (Judge 1975). He found very little evidence supporting irrationality of interest rate forecasts, as Friedman did analyzing Goldsmith-Nagan survey measures. This research found the Livingston inflation forecasts did not satisfy restrictions implied by rationality over the period of 1959 to 1969. This was also tested with liklihood ratio

statistics. Therefore, Mishkin states that further research evaluating the rationality of the Livingston's price expectations using longer sample periods than 1959 to 1969 is necessary before accurate conclusions can be made. The Mishkin study definitely indicates that the previous work done with the Livingston and Goldsmith-Nagan surveys are inconclusive, and further research is necessary to make concrete determinations.

Other Tests of Published Forecasts

Zarnowitz (1977), analyzed the accuracy of three sets of G.N.P. forecasts over several different time periods. The first group was a mean forecast of ten private forecasters. The second set was from the Economic Report of the President and the third is the Wharton and Michigan econometric model forecasts. The first group relates closely to the average analysts' estimates considered in the research reported here. Zarnowitz found evidence supporting the conclusion that the end of year forecasts, of current dollar G.N.P. next year, were reasonably accurate. The study found inflation and real G.N.P. forecasts to be less accurate.

He also found that the average error and correlation measures did not show large, consistent differences among the forecast sets compared. This agrees with earlier

studies, which report consistently superior forecasters as being nearly nonexistent. The analysis concerning individual analysts in this Cattle on Feed research used very similar procedures as the Zarnowitz study. Analyzing mean forecast errors is a common method for identifying forecasters who are more accurate than the population as a whole.

The only published research concerning agricultural economists located during this literature review was done by Cornelius et al. (1981). The study analyzed the Survey of Annual Outlook Information, sponsored by the American Agricultural Economics Association. No attempt was made to obtain a random or statistically representative sample in this survey. This study analyzed fifty-three forecasters in the 1978 survey and seventy-four in the 1979 survey.

Five commodities were used in the study to analyze the accuracy of price forecasts. Several evaluation statistics were used, including mean forecast error, root mean-squared error, mean percent error, and distribution of forecast errors. The study found accuracy to be better for short-run, as compared to long-run forecasts. A second finding was that forecast accuracy varied among commodities. In livestock, hog price forecasts were found to be more accurate than cattle price forecasts. The

final conclusion made in this study was that nine of seventeen forecasters had relatively better track records of slaughter cattle price forecasts over the two year period. The others exhibited a declining degree of accuracy. However, two years is not a large enough sample to make convincing conclusions. Cornelius and the others recognize this, but they also suggest that further analysis of forecast accuracy could be useful.

Market Effects of U.S.D.A. Commodity Reports

There have been several different studies analyzing the effects of U.S.D.A. Reports on market prices of major commodities. However, none of these studies had market expectations available to use in the analysis. The previous research reviewed on market price reactions only analyzed price movements surrounding the reports to determine economic impacts of the U.S.D.A. reports. That makes the research reported here unique, because a measure of pre-report expectations is available through the C.N.S. published estimates. However, previous research involving report effects on market prices are useful. These studies validate the economic rationality of price movements associated with the release of a government report.

Price Effects of U.S.D.A. Grain Reports

There have been two widely referenced studies of

U.S.D.A. Crop Reports and their market impacts. The first was published by Pearson and Houck (1977). They analyzed the hypothesis that prices rise in the event of the Crop Reporting Board reducing its crop production forecast and vice versa. They also studied market price volatility surrounding the reports. The research studied corn, soybean, spring wheat, and winter wheat markets. The data covered thirteen years and the statistical methodology was simple observations of price movements before and after report release dates.

The Pearson and Houck study found price reactions to be significant and economically rational for all four commodities, except winter wheat. Winter wheat was found to have no significant relationship between changes in anticipated production levels and prices the day following the report. The most significant relationship was found in the spring wheat market, where prices reacted immediately to changes in expected production. This was similar to their findings in the corn market. Significant relationships were determined in the soybean market, but only when forecast changes of less than .8 percent weren't included. Price volatility was concluded to be reduced in the two wheat markets, but increased in the corn and soybean markets the week following report releases.

The second grain market analysis was done by Gorman (1978). Gorman used regression models to determine the effect of crop reports on market prices. He concluded that a significant negative coefficient indicated that the corn market did a poor job in anticipating changes in the corn harvest. His results in the soybean market found an insignificant regression coefficient of the price change on the change in forecast production. This indicated that the soybean market did a better job of anticipating supply changes than the corn market.

Flackler reexamined the corn and soybean markets as well as some livestock markets, but his empirical research concentrated on the grain complex. Flackler analyzed price changes following crop reports in the corn and soybean markets. Specifically, he analyzed the variances and covariances of regression equations modelling price changes as a function of the production changes. The evidence indicated that traders found the production reports quite useful in adjusting production forecasts.

Flackler found a strong inverse relationship between changes in report estimates and price changes following reports in the corn market. This suggests that traders did not systmatically misjudge the information that they received between report releases. His conclusions in the soybean market were somewhat different. The strong

inverse relationship did not exist as it did in the corn market, but other evidence showed the reports to contain informational content. The soybean market appeared to adjust quickly to the information, with variances of price changes being larger on days following reports than other days. It also appeared that traders over-responded to information between reports, which magnified price changes after report release. Flackler maintained that more research is necessary to determine the rationality of traders regarding U.S.D.A. reports.

Price Effects of U.S.D.A. Reports in the Livestock Markets

Miller (1979) published some of the first research involving futures price reactions to livestock reports. Miller studied the live hog futures markets for 36 quarterly Hogs and Pigs Reports. He analyzed contracts from three to four months from delivery, and six to seven months from delivery relative to the report release. Miller used partial adjustment regression models, unadjusted and adjusted for correlation of errors across models. Comparison of these models served as the basis for his conclusions.

Miller found that the significant coefficients indicated that the futures market was surprised by the sow farrowings data contained in the reports. Secondly,

significant coefficients for lagged dependent variables indicated that the markets did not react immediately to the new information. Contracts three to four months from delivery made one-half of their price adjustment within one day. However, contracts six to seven months from maturity made one-half of their price response within one week.

Hoffman (1980) analyzed both the cattle market and the hog market reactions to quarterly livestock reports. Hoffman's analysis used quarterly percent changes in variables instead of actual numbers, similar to the data used in the methodology reported here. He studied 38 Cattle on Feed Reports between January 1970 and 1979. Thirty-seven Hogs and Pigs Reports were also included between March 1970 and March 1979. Regression equations were calculated for cash, and nearby and distant futures prices, as functions of the changes of the three Cattle on Feed variables. Similar equations were determined for the hog market. These regressions were similar to ones used in the study reported here, except the independent variables are forcast errors and not changes in actual numbers.

Hoffman found the announcement effect to only be significant in the cash market, and not in the futures markets studied. Nearby and distant futures were found to

be insignifcant in both the cattle and hog markets. This suggested that the futures market was more efficient than the cash market in predicting and assessing underlying supply conditions in both livestock markets. Cash cattle prices were found to be significantly affected by changes in placements during the previous quarter. Similarly, cash hog prices were affected by sows farrowing during the previous quarter. Hoffman's results are useful in comparison with those found in the research reported here for analyzing changes which may have occurred during the periods between the studies.

Koontz et al. (1984) researched the impact of Hogs and Pigs Reports on live hog futures prices in 1984. These researchers used the event-study methodology widely accepted and used in stock market literature. Nearby, intermediate and distant futures contracts were analyzed for each of thirty-six U.S.D.A. Hogs and Pigs Reports. Price changes for thirty-eight days surrounding report release dates were included. Reports were classified as bullish, neutral, or bearish based on the ratio of actual farrowings to final farrowing intentions. Two simple tests of market efficiency were used to examine the price changes. The first test examined the mean price changes surrounding the reports. These changes should have been consistent with the martingale hypothesis, which claims

the mean across the thirty-eight observations would have been zero. The second test analyzed the serial independence of successive price changes.

They found no significant evidence of inefficiency under the martingale hypothesis. Mean price changes ten days before and after and five days before and after release, showed that prices adjusted sharply to bullish information. Bearish reports caused downward price movements, while neutral reports caused slight upward reactions. The researchers concluded, "The dramatic price adjustments after the bullish and bearish March reports, suggests live hog futures markets may be information starved, particularly, following the winter months." Dramatic reactions were found after seven of the ten March reports. These results indicated that the hog futures markets basically reacted rationally to the quarterly Hogs and Pigs Reports.

Theory of Rational Expectations

Several sources were consulted in the literature review process to gain a basic understanding of expectation theories. This knowledge represents the background for nearly all of the studies reviewed thus far. Most of the literature examines the rationality or degree of efficiency associated with particular markets.

Rational Expectations is the theory which many of these studies used to form hypotheses. It is also the basic theory underlying the hypotheses used in the research reported here.

Rational Expectations

The theory of Rational Expectations was first hypothesized by Muth (1961), in his article entitled "Rational Expectations and the Theory of Price Movements". This original article remains the premier source for Rational Expectations models, which have become the dominant techniques of New Classical economists. Muth outlined his hypotheses of Rational Expectations and then developed the model from these hypotheses and from empirical observations.

Muth developed his model from a very simple demand and supply framework existing in an isolated market. The model described expected prices as a weighted function of past forecast errors. The theory proposed by Muth maintained that future price changes will only result from unanticipated changes in information, relevant to a particular market. Thus, the model described a dynamic relationship which is constantly moving towards an equilibrium, which is also changing with new information. Muth also introduced the effects of inventory speculation,

and rationality with respect to cobweb theorems in this article.

The Rational Expectations model remains a widely accepted theory today. However, Muth's original theory was not so well accepted during the early 1960's soon after its publication. The theory and its use did not become widespread until the late 1960's and early 1970's. It wasn't until this time that other economists began to use the theory in empirical work. The New Classical economists now rely on Rational Expectations in much of their research.

Two of these economists, (Lucas and Sargent 1981), compiled a large collection of published works using Rational Expectations. This book served as the major source for Rational Expectations in the research reported here. Thirty-four articles using Rational Expectations are assembled in this book. Articles by Muth; and Lucas and Sargent, were included as well as many others written by professional economists. Most of these articles dealt with specific issues in the macroeconomic area and were not applicable to this research.

One other source of Rational Expectations was consulted during the beginning of this literature review to facilitate the understanding of the basic theory. Maddock and Carter (1982) published "A Child's Guide to

Rational Expectations". This article presented the basic theory through a verbal conversation between Bert and Ernie, two fictional graduate economics students. The article was useful in developing a theoretical understanding, without a rigorous explanation of the mathematical model.

These two sources were used extensively in the first part of the literature review process. A basic understanding of Rational Expectations was necessary before further literature could be properly assessed. Nearly all of the articles reviewed mentioned the rationality of markets or the rationality of expectations. Without the knowledge acquired from these two sources, the correct interpretation of the relevant literature would have been difficult. The Rational Expectations Hypothesis was used in all of the literature reviewed, as well as in the model researched here.

Chapter III

Methodology

Efficient Markets and Rational Expectations

I. Cattle Market Efficiency

The theory of rational expectations is dependent upon markets which function in an efficient manner. The basic tenet of rational expectations is this: market participants will determine equilibrium prices, by summing all available information affecting the underlying value of the commodity in an economically rational manner. The degree of a market's ability to internalize all relevant information and represent this through price fluctuations is a measure of that particular market's efficiency. Analysis of rational expectations theory clearly shows its dependence on efficient markets.

A good foundation in market efficiency is important in gaining a clear understanding of the theory of rational expectations. An efficient market is one in which information is inexpensive and available and in which price already reflects all relevant and ascertainable information (Brealey and Myers, 1984). A problem arises when examining large public markets, such as securities and major cattle markets. Although these

markets are public and open to anyone with the money to trade, a question arises as to the availability of information. These markets are designed to be extremely efficient because all relevant information is supposed to be available to anyone desirous of the knowledge at virtually no cost. Thus, cases of insider trading as discovered in the stock and bond markets should be nonexistent.

Measurement of market efficiency is based on a market's ability to incorporate all information into its price discovery mechanism. Three forms of efficiency have been identified in the measurement of market efficiency. The first is termed the weak form of market efficiency. A market which is characterized by the weak form has prices which reflect only the information contained in the record of past prices. The second is the semistrong form in which current market prices reflect past prices and all other published public information. The third form is labelled strong. A strongly efficient market has prices reflecting past prices and public information, plus all other information that can be acquired through extremely detailed fundamental analysis. Rational expectations theory relies on efficient markets to explain how new information is incorporated into price, based on expectations.

Cattle markets display unique characteristics that would make them appear to be efficient. Stock and bond markets have been shown to exhibit semistrong efficiency and in some cases have proven to be even strongly efficient (Fama et al. 1969). Cattle markets differ from these "money markets" in two different ways which theoretically should make them even more efficient. However, the research on livestock market efficiency only support the weak and the semistrong forms (Leuthold and Hartmann, 1979). The two characteristics which cattle markets possess which theoretically support a stronger form of efficiency are cited below.

1) Cattle are commodities and thus are considered to be homogeneous products in commercial livestock trade.
2) There is little significant supply information which is not under the direct control of The United States Department of Agriculture. (The U.S.D.A.)

II. Rational Expectations

There are three theories of expectations which are common in economic research. The most simplistic approach to analyzing expectations is the Naive Expectations Model. Under the theory of Naive Expectations the analyst assumes

that past prices will continue in the future. The model simply states that price at time t will equal price at t-1. The second theory of expectations is the Adaptive Expectations theory which states that individuals use only prior information about previous forecasting errors to revise their current expectations. This model also only relies on past information reflected in previous prices (Lucas and Sargent, 1981). The theory of Rational Expectations extends the Adaptive Expectations model to account for future changes in information.

Rational Expectations is a relatively new theory first introduced by John F. Muth in 1961. The theory was not readily accepted until the New Classical economists began to advance this theory in the early 1970's. Robert E. Lukas Jr. and Thomas J. Sargent have done extensive research involving Rational Expectations throughout the 1970's and 80's. Their book Rational Expectations and Econometric Practice includes an extensive collection of journal articles involving different applications of this theory. Muth's article is the first chapter of the book and his basic theory remains the cornerstone of Rational Expectations.

Muth argues that individuals alter the basis of their forecasts much more rapidly than the adaptive expectations theory allows. The rational expectations theory implies

that price at any particular moment reflects all pertinent available information, and changes only as new information is analyzed and incorporated directly into the price. All pertinent information includes not only past information affecting future price but also expected future information which will influence price. Therefore prices will change only as a result of the introduction of new unanticipated information. Thus it is these informational "shocks" which cause price volatility.

Efficient markets are considered to be in equilibrium when available public and private information has been assembled, analyzed, and subsequently been incorporated into price. The information does not have to be correctly and uniformly interpretated by all participants in the market. As long as all market participants are aware of the information and incorporate it into their price forecasts, then the market is in equilibrium. An average forecast will emerge from the consensus of traders and thus will be reflected in the resulting market price determined through public auction.

Rational expectations maintains that price will not change from an equilibrium state until new unexpected information appears and thus "shocks" the market by causing all traders to subsequently revise their price expectations and negotiate a new price. This process will

continually repeat as new information becomes available. Thus, it is changes in information pertaining to an individual market that causes new prices to emerge. Therefore, the market constantly moves towards equilibrium which is constantly changing. This implies that a market can be completely rational, but still experience price volatility. The volatility would be directly correlated to the flow of new unanticipated information entering the market.

Recent research regarding rational markets has presented rationality in two forms. A market can either be fully rational, partially rational or both. Partial rationality is a necessary but not sufficient condition in determining full rationality. Full rationality means that all available information has been used in an optimal manner. This is not the same as completeness which means all usable information is being used, but not necessarily in an optimal manner. Like partial rationality, completeness is a necessary but not sufficient condition for full rationality. A partially rational market implies that the information actually used in forming prices is efficient whether or not it is complete. These definitions are useful in studying empirical results and testing Muth's theories regarding market rationality.

John Muth formed two major conclusions in his

studies of expectations data. The two conclusions are as follows.

(1) Averages of expectations in an industry are more accurate than naive models and are as accurate as elaborate equation systems, although there are considerable cross-sectional differences of opinion.

The Cattle on Feed average estimates appear to be classic examples of these type of average expectations referred to by Muth.

(2) Reported market price expectations generally underestimate the extent of changes that actually take place. The Cattle on Feed estimates are not price expectations, but they could be subject to this same phenomena.

Muth believes that these conclusions are relevant and should be considered in the empirical use of Rational Expectations. Muth's basic Rational Expectations hypothesis was formulated with these conclusions in mind. Muth stated the hypothesis in this manner; "Expectations of firms (or more generally, the subjective probability distribution of outcomes) tend to be distributed, for the same information set, about the prediction of the theory (or the "objective" probability distributions of outcomes.)"

This hypothesis implies three important considera-

tions about the economic system being analyzed. Muth asserts that the following three statements about the economic system under consideration are relevant to any empirical work.

(1) Information is scarce, and the economic system generally does not waste it.

(2) The way expectations are formed depends specifically on the structure of the relevant system describing the economy.

(3) A "public prediction," in the sense of Grunberg and Modigliani (1954), will have no substantial effect on the operation of the economic system (unless it is based on inside information).

The economic system analyzed regarding cattle markets exhibit many of the characteristics associated with perfect competition. These characteristics include free and widely available information, absence of inside information, many market participants and minor barriers to market entry and exit.

Muth further proposed a mathematical model from his Rational Expectations theory. The model is fairly complex and it would be tedious to outline the mathematics here. However, the basic model is available in Muth's original 1961 article mentioned previously. The model formulates future expected prices as a weighted summation of all previous forecast errors. The variables are all represented as deviations from equilibrium values.

The underlying economic principle of the Rational Expectations model is that market equilibrium implies demand equals supply. The demand for slaughter cattle is a negatively sloping linear function of the cattle price at time t. Ct = - B*pt. The equation modelling the supply of cattle is a positive linear sloping function of the slaughter cattle price at t, plus a statistical error term. The error term is included to account for unexpected variations such as the weather. The supply equation is: Qt=&*(Pet)+Ut. The error term is only included in the supply equation because production decisions must be made on the basis of anticipated prices. The error term is left out of the demand equation to simplify the model. The assumption is that demand is relatively stable for most commodities in the short run, and therefore an error term is unnecessary. As mentioned above, market equilibrium implies that Ct=Qt.

Where: Qt = the number of cattle produced for consumption in a period lasting as long as the production lag which can be as long as 24 to 36 months,

Ct = the number of cattle purchased and consumed,

pt = cattle market price in period t,

Pet = expected price of live cattle at time t, given available information up to and including time t-1,

Ut = an error term.

This basic model also has the intercepts removed which implies that the market equilibrium condition would occur at the origin. The error term in the supply equation is the only exogenous variable in the system and thus is the only variable which can shift the supply function along the fixed demand function. This is the reason that the model is described as a function of the forecast errors.

Cattle price at time t can be expressed as a function of expected prices and with all quantity variables removed as: pt=-&/B*(Pet)-(1/B)*Ut. The error term will be known at the time the commodity is purchased. However, for prediction purposes Ut is assigned its expected value which is conditional on past events. As long as the errors have no serial correlation and the expectation of Ut=0, we can express the expected price at time t as, E(pt)=-&/B*(Pet). Excess profits are not available, through insider knowledge, inventory speculation etc. and therefore aggregate expectations should equal the prediction, E(pt)=Pet. Through a similar analysis it can also be shown that the expected price for cattle at time t is Pet=-1/(&+B)*E(Ut).

To expand the analysis further and include more periods, the disturbance variables(Ei's) need to be written as a linear combination of the past history of

normally and independently distributed random variables with a mean of zero and variance S. This adds a weight to the disturbances based on time proximity to the predicted period. Thus recent forecast errors are weighted more heavily than those in the past. To be useful the equation needs to have observable variables that can actually be obtained from historical statistical series. More specifically, the expected live cattle price needs to be in the form of Pet = Sum(Vj)*(p)t-j.

This model is the basic rational expectations model as proposed by John Muth in the 1950's. The theory and the model is still widely accepted and has been expanded by Muth and others to apply to many specific areas of interest. The model can become fairly complex when applied to large dynamic macroeconomic theories. However, these models are beyond the scope and interest of this research and elaborations are not necessary.

Muth's theory can easily be applied to the cattle markets, because consumer beef demand is fairly stable. This allows the error term to be removed from the demand function. Cattle producers also have to make production decisions in the manner which this model describes. Producers make production decisions for a product that will not be marketed for as long as 24 to 36 months. They have to make this decision from a forecasted future

price. Thus, they experience very large forecasting errors between the the production decision and the time the cattle are marketed. Basic economic theory dictates that cattle prices are determined by balancing the demand and supply factors for cattle at any particular point in time. The demand and supply factors are represented through information. Rational expectations implies that cattle prices are formed by summing all available information affecting the supply and demand for cattle. Assuming positively sloped supply functions and negatively sloped demand functions, information indicating lower supplies of cattle and increased demand for red meat would cause price to be relatively higher than with information indicating larger cattle supplies and decreased consumer demand. Under rational expectations, all of this information would be incorporated in the market equilibrium price for slaughter cattle. The economic theory of supply and demand equilibrium also indicates that this information would be used to form the slaughter cattle price. Therefore, the two theories are consistent with each other and are completely compatible.

These two theories imply that cattle prices would be at a constant equilibrium if no new information was available to the market participants forming price. In actuality, prices change daily, and, in fast moving

markets, such as the cattle futures markets, price changes almost instantaneously. If these economic theories are correct, then new information is constantly being introduced and reflected through price changes. All market participants do not need to interpret the information correctly or exactly alike, as a consensus opinion will emerge and be reflected through price changes. The model is actually dynamic and is constantly adjusting towards an equilibrium. However, the equilibrium keeps changing as new information shifts supply and demand.

III. Cattle on Feed Reports and Pre-Release Expectations

The rational expectations theory has fundamental implications in analyzing the hypotheses concerning Cattle on Feed Reports and pre-release expectations. Cattle traders must simultaneously assimilate new information concerning the supply of and the demand for slaughter cattle as it is introduced to the market. The major supply factors affecting the slaughter cattle markets are the three figures contained in the U.S.D.A. Cattle on Feed Reports. Placements, marketings, and total numbers of cattle on feed are the variables that traders use to determine a supply function for slaughter cattle. Each month the government releases these figures to the public

based on their statistical survey procedure. The U.S.D.A. figures are the most extensively researched supply numbers and are generally perceived to be accurate measures of the present and near future supply of slaughter cattle. Assuming this to be true, the prices formed soon after the report should contain the most accurate information available concerning supply until the next report is released.

The government figures will remain in the participants accumulation of supply knowledge and will continue to be reflected in the equilibrium slaughter cattle price until the next report is released. However, this implies that the cattle on feed information will continue to have decreased significance as time progresses.

New supply information is introduced throughout the period between reports and is reflected in price changes as rational expectations theory predicts. This information may come through conversations with cattle feeders, private forecasts, or even through perceptions of U.S.D.A. inaccuracies. New demand information is flowing into the cattle markets during this time which also influences price change. Thus the information contained in the past Cattle on Feed Report is weighted less heavily over time.

This price formulation framework is a very useful model for studying the effects of the Cattle on Feed Pre-Release Estimates. By the time the estimates are published, the weight of the information contained in the previous report and assimilated into present prices is small. If the cattle market participants find the C.N.S. average estimates to be useful and accurate forecasts of the U.S.D.A. figures, then the estimates are contributing information. This information theoretically would be reflected in price changes occurring during the two days between the published estimates and the report release. This is true only if the information is considered new and is not already reflected in price through a consensus supply perception of traders. Otherwise, the information is old and is of little value to price formulation. Price changes for the two days following the estimates would be highly correlated with the forecasts if the information is of value. If the information is "already in the market,"(1) then the price changes would be uncorrelated with the average estimates.

Whether the information contained in the estimates is of value or not, price changes following a Cattle on Feed Report should be correlated with the forecast errors.

(1) "In the Market" is a term used by traders which means particular information has already been assimilated into price.

This is because the C.N.S. average estimates should reflect a consensus opinion of the three supply numbers, even if the information is not new and is already reflected in price.

If the sample survey used in the C.N.S. pre-release report is an accurate representation of cattle market participants, then these forecasts will already be incorporated in price. However, if the survey sample is perceived to possess skills or inside information not available to most market participants, then the pre-release estimates would have informational content which would be incorporated into price the following two days. In either case, the equilibrium price as measured by the settlement on the day of the government report should be a rational reflection of the participants' forecasts of the U.S.D.A. numbers. Therefore, the price changes occurring after the Cattle on Feed Report should be correlated with the differences of the three estimates and the U.S.D.A. figures.

A knowledge of rational expectations is necessary in researching the role of Cattle on Feed Pre-Release Estimates with the actual U.S.D.A. figures and associated price changes. The theory indicates that the closing cattle price on the day the estimates are published should reflect all available information,

including the estimates if the survey sample is representative of market participants. The closing price on the day the Cattle on Feed Report is released should reflect all demand and supply information available, excluding the U.S.D.A. figures which are not publicly known until after the cattle futures market closes. By analyzing price changes following the government reports, it should be possible to determine perceived supply before the report. The relationship between actual market perceptions and pre-release estimates could then be accurately analyzed. Theory dictates that price changes occurring after the Cattle on Feed Reports should be related to the differences in the published estimates and the government figures. The empirical relationships just mentioned should be accurate tests of this theory.

IV Theoretical Model

The proposed model to reflect price changes following a Cattle on Feed Report will be a function of the three U.S.D.A. figures and the three average estimates published by C.N.S.. The relationships among these three pairs of numbers should represent new information affecting the cattle market equilibrium price. There is a wide multitude of variables affecting cattle price and thus this model will not be expected to capture all of the

relevant information responsible for price changes. These other variables will simply be represented through the presence of an error term. This research will not attempt to model these other variables as they are not important to the objectives of this study. The proposed model is in the form below:

$$P = A0+A1*OF+A2*EOF+A3*PM+A4*EPM+A5*M+A6*EM+U$$

where: P = The price change following a Cattle on Feed Report,

OF = U.S.D.A. onfeed figure,

EOF = Average analyst estimate of the on-feed figure,

PM = U.S.D.A. placements figure,

EPM = Average analyst estimate of placements figure,

M = U.S.D.A. marketings figure,

EM = Average analyst estimate of marketings figure,

U = A statistical error term.

This basic model should forecast price based on the changes associated with the new information represented in the Cattle on Feed Report. Rational Expectations would imply that information which is considered surprising should cause larger price movements than what would be associated with anticipated information. This model should represent unanticipated information through large differences between the estimates and the actual numbers.

Similarly, anticipated information would be represented through small differences between the estimates and the actual U.S.D.A. numbers. Although there are many unexplained variables represented in the error term, theory would indicate that a correlation should exist among these independent variables and the dependent price change experienced in the cattle market. All six of the parameters should be statistically significant, if the cattle market behaves rationally to Cattle on Feed Reports.

Statistical Methodology

All five of the research hypotheses were analyzed statistically with Rational Expectations Theory serving as a framework for establishing specific tests. Each hypothesis was statistically tested and then analyzed before proceeding to the next hypothesis. Although, it should be noted that some of the tests results were applicable to more than one hypothesis. Therefore, certain tests are mentioned in the methodology pertaining to more than one of the hypotheses.

Hypothesis 1

The first hypothesis tested was to determine if the C.N.S. average estimates are representative of actual

supply anticipations held by market participants. The results of this hypothesis are essential to analyzing the other hypotheses and thus it was studied first.

Each of the three average estimates was first tested for partial rationality, which would indicate whether information used in these estimates is incorporated efficiently. Partial rationality was tested by determining if bias was present in the estimates. The presence of bias would lead to the rejection of partial rationality. This was accomplished by regressing the actual value as a function of the average estimate. An F-value was calculated for the specific test, that the intercept was equal to 0 and the independent variable coefficient was equal to 1. If the F value was rejected, then it indicated bias and a lack of partial rationality. Rejection of F meant that the average estimate was not a good estimate of the actual U.S.D.A. number. This procedure was performed on all three of the average estimates for both the quarterly and monthly data, as well as the combined data series. This is a well recoginized method for testing partial rationality and has been used in several studies involving forecasts of macroeconomic variables.

If the average estimates were found to be partially rational, then they were indirectly tested for full rationality. Full rationality means that all the

information used in forming these estimates has been used in an optimal manner. The test procedure used here involved statistical least squares regession. The forecasted errors (Actual U.S.D.A. # - Average Estimate) were regressed as a function of a lagged value of an actual figure. The lagged value represented known past information about the predicted figure. A T-test was performed on the independent coefficient to determine whether or not its value was 0. Rejection of the T-test at an alpha level of .05 indicated the prediction was not incorporating the information efficiently.

The full rationality test was run on each of the three average estimates for both the quarterly and the monthly data. The combined data set was not tested for full rationality; the lagged values would not make statistical sense when monthly data were interspersed with quarterly data. Lags of one and four periods were calculated on the quarterly data. The monthly figures were regressed with lags of one and twelve periods. These lags were chosen to represent information known from the previous period, and from one year previous to the prediction being made. The full rationality test has also been used to test macroeconomic forecasts in past research and is a widely accepted technique (Brown and Maital, 1981).

One problem encountered in previous studies was the presence of serial correlation between the forecast errors. The correlation arises because the realized values (Actual U.S.D.A. numbers) are not yet known. Thus the predictions are made only on past information. Serial correlation was tested for the average estimates by an Autocorrelation Test for White Noise (Ljung and Box, 1978). Rejection of the calculated Chi Square values at an alpha level of .05 would indicate autocorrelation among the forecast errors. The serial correlation tests were only performed on the quarterly and monthly data as the interpretation of lags would not have been possible with the combined series.

Hypothesis 2

Statistical Least Squares Regression was performed for the second hypothesis to determine whether the average estimates and the actual numbers directly influence the futures price reactions following Cattle on Feed Reports. The regession equations calculated in this test involved regressing price changes following the Reports, as a function of six variables. The six variables were the three U.S.D.A. numbers and the corresponding estimates. An F-value was calculated to test whether the estimate plus the actual was equal to zero (Draper and Smith,

1981). This was done for the three pairs of estimates. Rejection of this hypothesis would indicate that the average estimate was not an appropriate measure of actual market anticipation.

Nine regression equations were estimated for the combined data series which included the 108 observations. The quarterly and monthly data sets were not analyzed, as they had insufficient degrees of freedom to be of statistical significance. Regression equations were calculated for the first three nearby futures contracts. Price changes for the first three days following the Report were regressed as functions of the six variables. This was repeated for each of the three contract months analyzed. The three F-tests were also performed on each of the regression equations.

Hypothesis 3

Two tests were performed on the individual analysts' estimates to identify a group which was more accurate than the population. The first statistical test performed on this hypothesis was a T-test calculated on their mean forecast errors. (Actual U.S.D.A. figures - Estimates of Analyst X) (McClave and Benson, 1982). Rejection of these tests at the .05 alpha level indicated positive or negative bias over time, depending on the sign for each of

the 26 analysts. Positive bias would imply that an analyst consistently overestimated a figure while underestimation would have been present with significant negative T-values.

Three T-values were calculated for each of the 26 analysts - one for each of the Report estimates. The tests were only performed on the combined data series as the degrees of freedom for individuals on the split series were too small to produce significant results.

The second statistical procedure used to analyze this hypothesis involved calculating confidence intervals on the variances associated with the analysts' mean forecast errors (Newbold, 1984). The confidence intervals were calculated and then plotted for each of the 26 analysts and for all three of their estimates. The onfeed, placements, and marketings estimates were plotted in separate groups for comparison purposes. A visual split was drawn through each category of the data (onfeed, placements, marketings). This split was designed to separate analysts who had smaller confidence intervals and were also closer to the horizontal axis than the population as a whole. Confidence intervals falling below these lines were determined to represent analysts who were more accurate estimating that particular figure than the population.

Hypothesis 4

The results from hypothesis three were not concrete enough to proceed with the statistical analysis necessary to test hypothesis four. If a group of analysts were identified to be more accurate than the population, then these results would have been used to determine a better estimate of expectations. The accurate group would be weighted more heavily than the rest of the population and then this new estimate would have been tested for rationality. The statistical test would have been the same F-value calculated under the first hypothesis. Then the results could have been compared with the simple average estimate to recommend a more appropriate weighted average to be used by C.N.S.

Hypothesis 5

Statistical Least Squares Procedures were again used to analyze hypothesis five. The price changes following the Reports were the dependent variables. Regressions were run for price changes one day, two days and three days following the Report. The independent variables used in the regression models were the actual U.S.D.A. figures and the average analyst estimates published by C.N.S. Several different regression equations were calculated for

many combinations of the independent variables. The statistical tests used to determine the validity of the model were the standard F, T, and R**2 tests (Judge et al., 1975). These were evaluated at an alpha level of .05.

The regression equations found in the second hypothesis were first analyzed to determine their statistical modelling accuracy. Different variables were also used, such as directly calculating the forecast errors and using them as three seperate independent variables. Lagged prices were also used in some of the models to account for variability not found with the forecast errors. The addition of other explanatory variables were not considered as this would seem to deviate from the objectives of this research. The testing was done on the quarterly and monthly data sets and also on the combined series.

Chapter IV

Results and Discussion

Hypothesis 1

C.N.S. Cattle on Feed Pre-Release Estimates as measured by the analysts average is a rational reflection of market expectations concerning the supply of cattle.

Results

The first test run on hypothesis one was to determine whether the Cattle on Feed Average Pre-Release Estimates are partially rational. Partial Rationality means that the information actually used is embodied in price efficiently. Regression equations were run modelling the actual figures as functions of the average estimates. The quarterly, monthly, and combined data sets were used in this analysis. An F-test was used to determine whether the intercept was equal to zero and the slope equal to one. Results for the F-tests and their corresponding probabilities are presented in Table One on the next page.

Partial Rationality Tests

Table 1

	Quarterly Estimates		
	Onfeed	Placements	Marketings
Degrees of Freedom Numerator	2	2	2
Denominator	34	34	34
F-Value	0.9510	1.9758	1.2606
Prob. > F	0.3964	0.1543	0.2964

	Monthly Estimates		
	Onfeed	Placements	Marketings
Degrees of Freedom Numerator	2	2	2
Denominator	38	38	38
F-Value	0.3216	6.1133	1.1199
Prob. > F	0.7270	0.0050	0.3368

	Combined Data		
	Onfeed	Placements	Marketings
Degrees of Freedom Numerator	2	2	2
Denominator	106	106	106
F-Value	1.4017	5.5963	0.6218
Prob. > F	0.2507	0.0049	0.5389

The placements estimate is the only one which failed the F-test at an alpha level of .05. The monthly and combined placements figures both had calculated F-values with corresponding probabilities of less than .05. None of the onfeed or marketings estimates failed the F-test for any of the data sets analyzed.

The second testing procedure performed on hypothesis one involved determining whether the average estimates were complete. The regression model calculated the forecast errors as functions of known lagged values. Individual parameter T-tests were calculated for the hypothesis that the coefficient was equal to zero. Rejection of the T-test at an alpha level of .05 constituted a rejection of the full rationality hypothesis.

The tests were run seperately on the monthly and quarterly data as the lagged values would not correspond correctly with the combined data. The T statistics were calculated for all three average errors, although this was not necessary for placements, due to the fact that partial rationality was rejected. Partial rationality is a necessary condition for full rationality. The completeness test results are presented in Table Two. If the average estimates are rejected for completeness, then they are not fully rational.

Completeness Test Results

Table 2

	Quarterly Estimates		
	Onfeed	Placements	Marketings
Lag 1 Quarter	-1.0560	-2.1690	1.3210
T-Value			
Prob. > T	0.2993	0.0381	0.1965
Lag 4 Quarters	0.5700	-2.7690	-0.4670
T-Value			
Prob. > T	0.5731	0.0096	0.6442

	Monthly Estimates		
	Onfeed	Placements	Marketings
Lag 1 Month	-0.3720	0.6270	-0.5850
T-Value			
Prob. > T	0.7132	0.5364	0.5638
Lag 12 Months	-0.6900	-0.8850	-3.0450
T-Value			
Prob. > T	0.4964	0.3841	0.0053

The only significant T-values were associated with the quarterly placements estimate and the monthly marketings estimate. The placements T-values were basically ignored, because they could not possess full rationality after failing the test for partial rationality.

The final tests calculated on this hypothesis were to determine if autocorrelation was present among the forecast errors. Autocorrelation was tested by the

Autocorrelation Test for White Noise, through the use of Chi-Square techniques (Ljung and Box, 1978). The Statistical Analysis System (SAS, 1982) calculated Chi-Squares for the three average estimates. Lagged periods of six, twelve, and eighteen were used to test for autocorrelation. Probabilities less than .05 identified autocorrelation present at the respective lag period. The autocorrelation results are presented in Table Three.

Table 3

Autocorrelation Results

	Onfeed	Placements	Market	Onfeed	Placements	Market
6 Period Chi Square	7.060	11.360	12.180	9.890	8.570	7.670
Degrees of Freedom	6	6	6	6	6	6
Prob. >	0.316	0.078	0.058	0.129	0.200	0.263
12 Period Chi Square	8.830	19.370	17.770	14.910	13.640	13.630
Degrees of Freedom	12	12	12	12	12	12
Prob. >	0.717	0.080	0.123	0.247	0.324	0.325
18 Period Chi Square	11.300	26.410	18.820	24.130	22.860	27.530
Degrees of Freedom	18	18	18	18	18	18
Prob. >	0.881	0.091	0.403	0.151	0.196	0.070

There were no Chi-Square values calculated that were significant at the .05 alpha level for any of the three estimates with the three lagged periods tested.

Discussion

The partial and full rationality tests both require that the forecast errors not be correlated. The statistical package calculated the Chi-Square values of autocorrelation for periods of six, twelve and eighteen. There were no signifcant Chi-Square values at the .05 alpha level, so it can not be determined that autocorrelation is present between the individual forecast errors at the .05 level. However, five of the eighteen tests would have been rejected at the .10 alpha level. The .05 level was chosen arbitrarily for all of the statistical tests used in this research. The presence of five Chi-Squares significant at the .10 level was an important consideration in the partial and the full rationality tests.

The tests for partial rationality were designed to determine whether the average analysts' estimates are biased forecasts of the U.S.D.A. numbers. The evidence indicated from the F-tests that the placements figure is not an unbiased estimator of the government number. Both the monthly and combined data sets had significant F-values at the .05 alpha level. None of the onfeed or

marketings estimates were found to be biased at this level of significance. Therefore, the average placements estimate is not an accurate forecast of the U.S.D.A. figure, and the hypothesis of partial rationality can not be accepted.

The partial rationality hypothesis for the marketings and onfeed average estimates was not rejected. It was therefore concluded, that these two average estimates are unbiased forecasts of the corresponding government figures. Partial rationality is a necessary condition for full rationality, so further rationality testing is justified for the onfeed and marketings average estimates, but not the average placements estimate.

The full rationality hypothesis was tested for all three average estimates and the results were consisent with the partial rationality results. Although, the full rationality test was unnecessary for the average placements estimate, the T-tests also caused rejection of the full rationality hypothesis in the quarterly estimates data. The onfeed average estimate was not rejected for full rationality in the quarterly and monthly tests with any of the lag periods tested. The full rationality hypothesis was rejected for monthly marketings with a twelve period lag. This is not a major concern, considering the other three T-tests on the marketings data

did not indicate rejection of the full rationality hypothesis.

Overall, these results were not too surprising, given the common perception of the difficulty associated with the prediction of placements. The average onfeed and marketings figures appeared to be fully rational estimates of the U.S.D.A. numbers. Therefore, these forecasts are unbiased and are incorporating past information efficiently. The average placement estimates do not appear to be rational and should not be relied on as an accurate predictor of the U.S.D.A. placements figure. The results are generally consistent between the monthly and quarterly data sets, as well as other results produced from testing further hypotheses. The analysts seemed to have an accurate anticipation of the onfeed and marketings numbers, but generally lacked accuracy in placements predictions.

Hypothesis 2

Futures price reactions following a Cattle on Feed Report are directly related to the differences in trade pre-report simple average estimates and the U.S.D.A. numbers.

Results

The only tests run on hypothesis two were to calculate several different statistical regressions modelling price changes following Cattle on Feed Reports. The price changes were regressed as functions of the three U.S.D.A. figures, and the three average estimates. F-tests were calculated to determine if the government number plus the average estimate was equal to zero. These were run on only the combined data sets, as the price changes did not correctly correspond with the split data. Price changes for one, two, and three days following the Cattle on Feed Report were regressed for the three nearby live cattle futures contracts. F-statistics were calculated for the hypothesis that the average estimate was an accurate measure of market anticipations. Probabilities less than .05 caused rejection of this hypothesis. The results are presented in Table Four.

Results of the Market Expectations Tests

Table 4

	Combined Data Set			
	Degrees of Freedom	F-Value	Prob. > F	Durbin Watson
First Nearby Contract				
Price change 1 day after release (Pt+1 - Pt)				
Onfeed Estimate	96	0.0380	0.8458	2.048
Placements Estimate	96	5.2037	0.0247	2.048
Marketings Estimate	96	0.7253	0.3965	2.048
Price change 2 days after release (Pt+2 - Pt)				
Onfeed Estimate	101	0.1142	0.7361	2.089
Placements Estimate	101	0.6441	0.4241	2.089
Marketings Estimate	101	1.3884	0.2414	2.089
Price change 3 days after release (Pt+3 - Pt)				
Onfeed Estimate	99	0.5948	0.4424	2.127
Placements Estimate	99	0.2499	0.6183	2.127
Marketings Estimate	99	1.5871	0.2107	2.127
Second Nearby Contract				
Price change 1 day after release (Pt+1 - Pt)				
Onfeed Estimate	96	0.6667	0.4162	1.916
Placements Estimate	96	12.7417	0.0006	1.916
Marketings Estimate	96	0.0628	0.8026	1.916
Price change 2 days after release (Pt+2 - Pt)				
Onfeed Estimate	99	0.1271	0.7223	2.107
Placements Estimate	99	5.4238	0.0219	2.107
Marketings Estimate	99	0.5504	0.4599	2.107
Price change 3 days after release (Pt+3 - Pt)				
Onfeed Estimate	99	0.0977	0.7553	2.235
Placements Estimate	99	3.5892	0.0611	2.235
Marketings Estimate	99	1.3511	0.2479	2.235

Table 4 cont.

Third Nearby Contract				
Price change 1 day after release (Pt+1 - Pt)				
Onfeed Estimate	97	0.9220	0.3393	1.965
Placements Estimate	97	15.2861	0.0002	1.965
Marketings Estimate	97	0.3500	0.5555	1.965
Price change 2 days after release (Pt+2 - Pt)				
Onfeed Estimate	100	0.1300	0.7233	2.087
Placements Estimate	100	8.4188	0.0046	2.087
Marketings Estimate	100	0.1277	0.7216	2.087
Price change 3 days after release (Pt+3 - Pt)				
Onfeed Estimate	100	0.0076	0.9306	2.181
Placements Estimate	100	5.5647	0.0203	2.181
Marketings Estimate	100	0.3391	0.5617	2.181

The only significant F-values calculated are for the placements estimates.

Discussion

The results for the hypothesis that the average analysts' estimates are rational reflections of market anticipations, were consistent with the results from hypothesis one. This hypothesis was only rejected for the placements average estimates for price changes following Cattle on Feed Reports in each of the three nearby contracts. The hypothesis is rejected for the first contract one day following, but not for two and three days following release. This was expected. Price reactions

in the nearby contract should not be dependent on placements as they have no direct price implications that soon in the future. A possible explanation for the rejection of the first day following; would be that the nearby contract moved in conjunction with later maturities as the market intially reacted to the Report. The next two days the nearby would tend to act independently of the others and therefore, the hypothesis was not rejected.

The placements hypothesis was rejected in all cases in the second and third contracts except for the second contract three days after the Report. It was significant at the .0611 level. Rejection of the hypothesis in the case of average placements was expected, given that the estimates are not rational predictions of the U.S.D.A. figures. This would indicate that the market is anticipating a placements figure different from the average estimate. Unfortunately, it was not determined whether market anticipations were more rational than the average estimate, or not. However, it appeared that the market was aware that the average estimate was not a rational forecast of the government placements figure.

There were no instances where the market anticipations hypothesis was rejected for the the marketings or the onfeed average estimates. The probabilities for the onfeed figures tended to be higher than the marketings

estimates across days and contracts, but not in all cases. These results were also consistent with those from hypothesis one. The market anticipations of the U.S.D.A. figures did not appear to be significantly different than the average C.N.S. estimates for the onfeed and marketings figures. The onfeed average estimate was apparently a more accurate measure of market anticipations than the marketings estimate, in general.

The results from the statistical analysis indicated that the average estimates published by C.N.S. for Cattle on Feed Reports are accurate barometers of market expectations in two of three cases. The onfeed and marketings average estimates appeared to be rational indicators of market expectations measured through price changes. However, the average placements figure is not an accurate measure of cattle market anticipations. This indicated that the cattle market was efficient in analyzing information, because the placements estimate was not rational while onfeed and marketings estimates were.

Hypothesis 3

A subgroup of analysts consistently outperform the population surveyed by Commodity News Services in their predictions of U.S.D.A. Cattle on Feed numbers.

Results

There were two tests performed in the analysis of the third hypothesis. The first test involved calculating a T-value for the mean forecast error on each of the three estimates and all of the twenty-six analysts included. T-values calculated greater than the critical value of T at the .05 level and corresponding degrees of freedom, caused rejection of this hypothesis. Rejection of the null hypothesis indicated that an analyst tended to bias his or her predictions over time. Positive significant T-values indicated positive bias and negative significant values indicated negative bias. The 78 T-tests results are given in Table Five on the following page.

Results of Tests on Individual Analysts

Table 5

Analyst Number	Degrees of Freedom	Critical T-Value	Placements T-Value	Marketing T-Value	Onfeed T-Value
1	19	1.729	1.43	-0.80	-0.44
2	30	1.697	0.19	0.17	-1.35
3	48	1.679	0.31	-1.26	-1.58
4	31	1.696	0.84	-1.02	0.08
5	54	1.675	1.61	-2.07	0.05
6	46	1.680	0.35	0.09	-0.89
7	22	1.717	1.36	0.39	-0.01
8	25	1.708	0.76	-1.23	-0.79
9	43	1.682	2.37	-1.15	0.52
10	50	1.678	1.73	-1.76	1.07
11	26	1.706	0.92	-1.09	-0.45
12	58	1.672	0.84	-1.70	0.15
13	45	1.682	1.21	-2.02	0.33
14	39	1.685	1.24	-2.13	0.13
15	52	1.676	1.50	-2.55	0.39
16	34	1.689	-0.65	-0.49	-0.31
17	27	1.703	0.61	0.14	-0.27
18	21	1.721	-1.16	-0.96	0.13
19	25	1.708	2.03	-0.01	0.35
20	29	1.699	0.05	-0.87	0.14
21	48	1.679	-0.30	-1.19	-0.43
22	48	1.679	0.30	-1.12	-0.08
23	45	1.682	0.58	-2.07	-0.06
24	45	1.682	0.80	-0.59	-0.79
25	35	1.691	0.27	-0.69	-1.48
26	20	1.725	0.30	-1.65	-0.06

The T-tests caused rejection of the null hypothesis that individual estimates were unbiased in ten of the 78 tests performed. Seven of the marketings estimates were rejected for unbiasedness, while three of the placements estimates caused rejection of the null hypothesis. Rejection of this hypothesis was not necessary for any of the onfeed estimates.

The second set of tests performed on hypothesis three involved calculating confidence intervals on the variance associated with each analyst's mean forecast error. This was done for each of the three estimates and for all twenty-six analysts included in the analysis. The confidence intervals were plotted for each group of estimates, (onfeed, placements, marketings) with the twenty-six analysts plotted together within each group. A line was drawn through each group to subjectively identify analysts which visually appeared to be more accurate than the population. Visual criteria included smaller confidence intervals which were also closer to the origin. The plots are included in Appendix One.

Discussion

The results from the T-tests on analysts' biases indicated that some biases are present among the individual analysts with their placements and marketings figures. There were ten estimates which were found to be biased among the 78 tested. They were randomly dispersed among the twenty-six analysts with one exception. One analyst was found to exhibit two bearishly biased estimates over time. This analyst had bias present in his or her placements and marketings forecasts. This indicated that his or her placements estimate was

consistently greater and marketings estimate was smaller than the actual figures. None of the analysts reported onfeed estimates which were consistently biased over time.

Using an alpha level of .05, one would expect to find four or fewer estimates exhibiting bias, which is 5% of the 78 observations. Since there were ten identified in this analysis, the hypothesis of unbiased estimates must be rejected. However, the fact that only one of the twenty-six analysts was found to exhibit more than one bias, indicated that there was probably little or no intentional misrepresentation of estimates. Because the biases are probably present due to random chance, the analysis designed to identify a more accurate subgroup was still considered valid.

The confidence intervals calculated in this test are accurate, well accepted statistical tests. However, the lines drawn through the plots to seperate the estimates was done purely by visual inspection. This analysis does not carry significant statistical merit. The results were rather inconclusive. Four onfeed, two placements, and six marketings estimates were subjectively identified as being more accurate than the population of analysts. Two of the analysts were found to have two of their estimates as being more accurate. None of the analysts were found to have all three of their estimates in this category.

Therefore, any attempt to identify a subgroup of extremely accurate analysts would have been in vain. There is not enough evidence to conclude that a group of analysts was better than the population at forecasting Cattle on Feed numbers over the period analyzed.

The plot of the confidence intervals on the standard deviations for the mean forecast errors does provide information. The plot was included to show that a subgroup of analysts could not be identified which was more accurate than the population. Secondly, the plots also show the relative forecasting difficulty of the three estimates. The wide confidence intervals associated with the placements estimates relative to the other two, indicated that it was a much more difficult forecast. The marketings and onfeed confidence intervals are smaller and closer to the horizontal axis than the other two. This indicated that these figures are easier to predict than the placements figures. The onfeed figures also appeared to be more difficult to forecast than the marketings, but the plots are somewhat inconclusive. These results are consistent with the findings of the first two hypotheses, which indicated that the average placements estimate was not rational, and was not an accurate measure of market expectations.

Hypothesis 4

A different pre-release estimate can be formulated which will be a better estimate of true supply expectations held by market participants.

Results

No statistical tests or models were computed with regards to this hypothesis, due to the results of hypothesis three. If a group of accurate analysts had been identified in the analysis of hypothesis three, regressions would have been run to determine better estimates of market anticipations. The accurate group would have been weighted more heavily than the rest of the analysts, to determine an average estimate which was better than the simple average reported by C.N.S.. The results from the second hypothesis also indicate that this was unnecessary.

Discussion

The average estimates appeared to be fairly accurate measures of market anticipations in the case of onfeed and marketings. The placements average estimate is not a proper measure of market expectations, but the results of hypothesis three do not indicate that a weighted measure could be derived which would be any better. Therefore,

it was concluded that the average estimates serve as a fairly good proxy of market expectations concerning Cattle on Feed numbers.

Development of a different, more useful barometer of anticipations would be extremely difficult given the results found here. Actual market anticipations for placements would have to be determined. Then it would have to be incorporated with the marketings and onfeed estimates to calculate another measure of anticipations. This however, has been determined to be beyond the scope of this study due to the results of the first three hypotheses.

Hypothesis 5

A model can be developed which will predict price changes following Cattle on Feed Reports, based on the numbers contained in the Report relative to the pre-release estimates.

Results

Many different combinations of regression equations were calculated to model price changes following Cattle on Feed Reports. Standard statistical measures of goodness of fit were used to determine the predictive ability of the models. These included T-tests on individual

variables, model F-tests, and R**2 statistics. Only Cattle on Feed numbers, pre-release estimates, and corresponding relationships were used as independent variables. A few exceptions involved the use of lagged futures prices to represent all previous relevant information. Full information rationality models were not tested as this was beyond the intent of this research.

A major assumption of these models was that the Cattle on Feed Reports introduced a relatively large amount of information into the market. The models were designed to only predict price changes within a few days following the reports. Thus, the assumption was that the information contained in the Cattle on Feed Reports dominated the price changes during those few days. The three best models and their corresponding statistical measures are presented in Table Six.

Estimated Futures Price Forecasting Models

Table 6

Explanation of Variables

FuIDifJ = Price change (Pt+j - Pt) for the ith nearest contract to maturity.

Onfeed = Average analysts' estimate of the U.S.D.A. onfeed number.

Place = Average analysts' estimate of the U.S.D.A. placements number.

Table 6 cont.

Market = Average analysts' estimate of the U.S.D.A. marketings number.

USfeed = The U.S.D.A. total onfeed # for the first of the month.

USmark = The U.S.D.A. marketings # for the previous month.

USplace = The U.S.D.A. placements # for the previous month.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu1Dif1 =	Market	-0.061611	-1.985	0.0500
	Onfeed	0.084411	2.334	0.0217
	Place	0.050996	2.226	0.0284
	USmark	0.046868	1.695	0.0934
	USfeed	-0.087758	-2.525	0.0132
	USplace	-0.026031	-1.577	0.1182

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.1703	4.49	0.0005	2.048

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif1 =	Market	-0.066361	-2.245	0.0270
	Onfeed	0.091592	2.677	0.0087
	Place	0.076414	3.506	0.0007
	USmark	0.062202	2.376	0.0195
	USfeed	-0.104868	-3.191	0.0019
	USplace	-0.039272	-2.506	0.0139

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.2913	7.986	0.0001	1.916

Table 6 cont.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif1 =	Market	-0.045244	-1.719	0.0889
	Onfeed	0.068912	2.25	0.0267
	Place	0.083456	4.307	0.0001
	USmark	0.053935	2.299	0.0236
	USfeed	-0.082890	-2.815	0.0059
	USplace	-0.047307	-3.381	0.0010

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.3274	9.358	0.0001	1.965

The intercepts were not included in Table Six because they were relatively unimportant to the analysis of these regressions. Many of the other models were included in Appendix Two, as they were not as statistically significant as the three models listed here.

The three regression models included in Table Six all measure the price change the first day after the release of Cattle on Feed Reports. The R**2 values all increased as futures contracts farther from maturity, are regressed against the variables. The F-statistics also became more significant the farther away from maturity. However, they were all significant at the .05 alpha level. The Durbin Watson statistics were all very close to 2.00, and so there was no reason to suspect a problem with autocorrelation.

The individual T-values were generally significant at the alpha level .05 for all three equations. The second contract had all six parameter T-values significant at the .03 level or less. It should also be noted that the U.S.D.A. coefficients were generally equal in absolute value, but opposite in sign to the average estimate coefficients. These tests were performed and reported in the results of the second hypothesis. The placements figures were the only ones which did not consistently conform to this hypothesis.

Discussion

The regression models reported in Table Six were the best predictive models calculated, given the constraints from the assumptions of this research. Unfortunately, the assumption that the Cattle on Feed Reports introduced information which dominated the cattle futures markets the days following release, appeared to be unrealistic. The highest adjusted R**2 calculated, was on the third contract for one day after release, and it was only found to be .3274. An equation which only explained one-third of the variability in price changes would not be an useful predictive model. The other statistical measures are fairly significant, but the predictive ability was not strong enough with a R**2 of only .3274.

The low R**2 value indicated that there was a large

amount of other information influencing cattle futures prices. The regression results indicated that the Report numbers and pre-release anticipations were definitely influencing factors on the price changes following reports. However, they did not dominate the information set used in establishing prices, as was assumed in this study. These results were not too surprising, considering the vast amount of information which flows into these markets at an extremely fast pace. The fact that the parameter coefficients were significant, indicated that these variables should be included in further full information rationality models.

It should also be noted that the "best fit" models all included price changes the day immediately after the Report release dates. Price changes for two and three days following the report did not correlate as strongly with the six variables. This indicated that the information contained in the Cattle on Feed Reports influences market prices very quickly. Even the information contained in the reports did not seem to be all that significant, given the R**2 values reported.

There appeared to be a large amount of information influencing price changes in cattle futures markets the days following Cattle on Feed Reports, besides the Reports themselves. Therefore, it did not seem possible to

effectively predict price changes without including many other variables influencing the cattle futures markets. The full information rationality model would have to include many other variables to raise the R**2 value of the regression equation to a better predictive level. Determining these other variables and building a useful price change predictive model was beyond the interests and time limitations of this research.

The most important information obtained from these models was that the coefficients were significant, and that they tended to be equal in absolute value, but opposite in sign. These facts could be used effectively by researchers to develop price prediction models for cattle futures markets. However, the determination of these models will be left for further research.

Chapter V

Conclusions

The main conclusions and implications of the research reported here can be summarized by analyzing the achievement of the study's main objectives. Interpretation of certain hypotheses results can also help in forming important conclusions not fully covered through discussion of the objectives. The final conclusions should be analyzed in relation to the Problem Statement, to determine if they can contribute solutions to the identified problem.

Objective 1

Objective one was designed to determine the actual supply expectations held by cattle futures markets participants at the time the Cattle on Feed Reports are released. The Cattle on Feed Report includes three major supply figures. The total number of cattle onfeed for the first of the present period, and marketings and placements of cattle for the previous period are the three key numbers. The objective has been adequately satisfied in regards to two of the three supply figures.

The C.N.S. published simple average estimates are relatively accurate indicators of actual supply perceptions held by market agents in the cases of onfeed

and marketings. These figures are published by C.N.S. two days before the release of the actual government report. The average estimates are calculated from a survey conducted by C.N.S. before each report, including approximately twenty to twenty-five cattle market analysts. The high and the low estimates are dropped, and a simple average is calculated for the analysts. These two figures are published along with the placements estimate before every Cattle on Feed Report. The research reported here has concluded through statistical techniques that the marketings and onfeed average estimates can be used as accurate indicators of overall market anticipations.

The market perception of the number of cattle placed on feed during the previous period however, was not able to be deduced from this research. It is clear that the average estimate for placements reported by C.N.S. is not an unbiased forecast of the U.S.D.A. figure, and that market agents recognize this. The research indicated that the market has different expectations for placements than those measured by the C.N.S. average figure. However, this research was not able to ascertain how the market arrives at a consensus forecast for placements. It is possible, that cattle futures traders actually use a weighted average estimate from the analysts survey. It is also possible that the figure is so difficult to predict

that market agents do not form a clear consensus opinion at all. Unfortunately, the research reported here failed to determine an answer to this question, and thus did not fully satisfy this objective.

Objective 2

The conclusions formed about the second objective of this research were partially reported in the discussion concerning the first objective. The second objective was to determine what role the C.N.S. published estimates play in the determination of market expectations. The average placements estimate was found to be a biased and irrational forecast of market expectations. The average placements estimate was determined to be an unimportant and relatively useless tool in forming market supply expectations. Therefore, the average placements estimate did not play a significant role in determining pre-release expectations during the period analyzed.

The average onfeed and marketings estimates did appear to play a role in the market expectations for these figures. These two figures were found to be partially and fully rational forecasts of the U.S.D.A. corresponding figures. They were also found to be rational reflections of market expectations through this research. Therefore, the marketings and onfeed estimates reported by C.N.S.

contain useful information. Their publication allows everyone interested, to determine accurately what the futures market anticipates the Cattle on Feed corresponding figures to be. The publication of the placements figure also may provide information to the market. Although it is not an accurate indicator of market expectations, the average placements estimate at least represents a consensus of what market analysts expect.

The conclusion formed about objective two is that the published average estimates provide information to the market. They are also accurate measures of pre-release expectations held by the cattle futures traders in the cases of onfeed and marketings estimates. Market expectations of placements were not determined, but definitely can not be measured by the average estimate published by C.N.S. Therefore, the usefulness of the placements average estimate was not identified. The average analysts' estimates should continue to be published as they provide information and do play a role in market anticipations.

Objective 3

The third objective was to identify whether the price volatility surrounding Cattle on Feed Reports was related to the relationship between the pre-release average

estimates and the U.S.D.A. numbers. Statistical regressions indicated that the pre-release average estimates and the Cattle on Feed numbers are significant variables related to price changes after the reports are released. The significance is strongest the first trading day immediately following report release dates and decreases on subsequent days.

The main implications of the significance found between forecast errors and price changes was that the market appeared to rationally incorporate this information into price very quickly. This would indicate that the cattle futures markets are efficient at internalizing the information contained in Cattle on Feed Reports. This implies that future forecast errors will significantly influence subsequent price changes. However, it was also determined that a large amount of other information is influencing these price changes as evidenced by the low R**2 statistics. This evidence gives an excellent starting point for a full information rationality model which would explain price changes following Cattle on Feed Reports.

Hypotheses 3 and 4

The research involved in the analysis of the third and fourth hypotheses have implications for the overall

conclusions of this research, although they are not specifically included in the objectives. Both of these hypotheses were included in the research to identify a weighted average estimate which would be a better reflection of market expectations than the simple average reported by C.N.S.. The conclusions formed regarding the first two objectives have direct influence on these hypotheses.

A group of analysts who were more accurate than the population as a whole was not identified in the research reported here. This could be due to the extreme difficulty of economic forecasting, as other research has reported, or other phenomena. One possibility is that the group of analysts surveyed by C.N.S. is not representative of the population as a whole. The survey group may in fact be more accurate than the overall population. This might be expected, considering that C.N.S. would want to publish the most useful estimates to its clients, which would be the most accurate estimates. Whatever the reason, an accurate subgroup of analysts was not adequately identified for use in another average.

The hypothesis that a more accurate average could be developed by a weighting scheme was rejected within the context of this research. The possibility of a more accurate measure still exists, especially in the case of

placements forecasts. The results of this research basically indicated that a different average was not all that neccessary. The marketings and onfeed simple averages represented market expectations fairly accurately over the period studied. The development of an alternative for placements would probably be useful, but market expectations would first have to be determined for this figure. That could be a large task in and of itself.

Objective 4

The fourth objective of this research was to develop an accurate predictive model for price changes occuring after Cattle on Feed Reports, based solely on the information contained in them. The conclusions concerning this objective have basically been discussed under the previous objectives. The results of the research reported here indicated that it is not possible to derive an accurate price change predictive model with only the Report numbers and pre-release expectations.

The cattle futures markets were shown to be efficient in their incorporation of the supply information released in the Cattle on Feed Reports. The six variables are statistically significant at probability levels of .05 and less. The calculated F-statistics are also statistically significant at very low alpha levels. These results

indicated that the expectations and resulting supply numbers are important variables in explaining price variation surrounding the Report releases. However, the R**2 statistics were not large enough to accurately forecast price changes. This indicated that there is a significant amount of other information contributing to the variability in price movements. Therefore, this objective was not satisfactorily accomplished through the research reported here. An accurate prediction model for price changes following Cattle on Feed reports would require the inclusion of many more variables. The research necessary to identify and calculate those variables does not fall within the restrictions of this project. The results concerning the significance of these six variables could be used to contribute to a full information model.

Problem Statement

The true success of this research can be judged by implications for its conclusions in helping to solve questions related to the main problem statement. The problem researched here was indirectly concerned with the price volatility issue, which is perceived to be extremely high in cattle futures markets during days surrounding the release of Cattle on Feed Reports. The volatility

issue was not directly addressed. The purpose of this research was to determine if the price volatility surrounding Report release dates is rational relative to the information of the Reports. Specifically, published pre-release estimates of the U.S.D.A. numbers were examined for rationality and their resulting influences on the cattle futures markets were scrutinized.

The results of the research reported here would support the continued publication of the pre-release estimates. In general, the pre-release estimates published by C.N.S. would appear to be accurate measures of market expectations. The onfeed and marketings estimates are fully rational estimates, while the placements estimate is not. The estimates have a strong correlation with the actual figures and the resulting relationship signficantly influence price changes. However, these price changes were not found to be completely related to the Cattle on Feed figures. In fact, they were shown to represent less than 50% of the variability associated with price changes following Reports.

These results imply that the cattle futures markets are efficient in the incorporation of information. The perceived price variability associated with Cattle on Feed Reports is not unwarranted given the influence of the

reports themselves. The results found here indicated that the elimination of published pre-release estimates, as some producer groups have called for, would serve no useful purpose. In fact their elimination would reduce the amount of beneficial information entering the cattle futures markets and would reduce their efficiency. There was no evidence from this research that would substantiate the claim that the pre-release estimates "serve no economic purpose to the cattle feeding industry" (Brundrett 1985).

Proposals for further Research

1) Price Volatility Issue - There exists a definite perception among cattle producers and their respective organizations that the variability in cattle futures prices increases dramatically after the release of Cattle on Feed Reports. This issue was not addressed in the research reported here, but the results reported have direct implications about the volatility and whether it is greater, or not. The degree of price volatility would be an interesting research topic and could provide useful results in addressing the producers problem.

2) A second area of needed research was also identified from the results reported concerning the irrationality of the average placements estimate.

Research that would be designed to determine the actual market expectations of placements at the time of Cattle on Feed Reports would be useful. The results reported here can only conclude that market placements anticipations are not adequately measured by the average estimate published by C.N.S.. Further research could identify actual market expectations of placements, if a consensus exists. If one does not exist, then this knowledge would still be beneficial in other attempts at modelling.

3) A third area of research analysis identified from this study would be the determination of a full information rationality model for price changes following Cattle on Feed Reports. The pre-release estimates and the actual government figures have been found to be significant variables, and would serve as a good starting point for further research. Other variables would have to be identified and accurately introduced into the model. The addition of more significant variables should increase the predictive abilities of the model. An accurate predictive model could help cattle producers identify variability and better prepare for it through well managed hedging programs.

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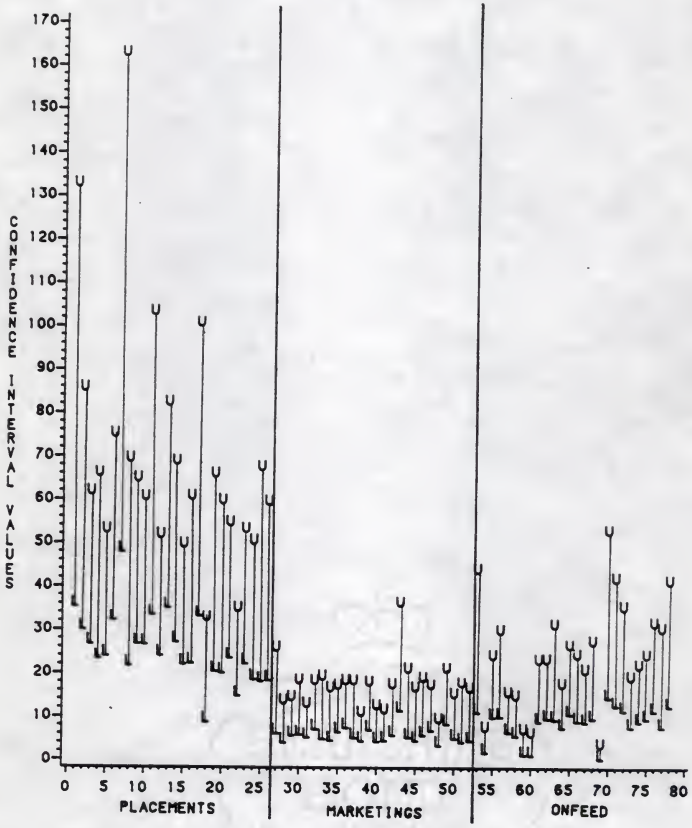
APPENDIX 1



CONFIDENCE INTERVALS FOR INDIVIDUAL ANALYSTS' MEAN FORECAST ERRORS

Appendix 2

Explanation of all Variables used in Appendix 2

FuIDifJ = Price change (Pt+j - Pt) for the ith nearest contract to maturity.

OneIBef = Closing futures price for first nearby contract the ith day before the Cattle on Feed Report.

TwoIBef = Closing futures price for the second nearby contract the ith day before the Cattle on Feed Report.

ThrIBef = Closing futures price for the third nearby contract the ith day before the Cattle on Feed Report.

Onfeed = Average analysts' estimate of the U.S.D.A. onfeed number.

Place = Average analysts' estimate of the U.S.D.A. placements number.

Market = Average analysts' estimate of the U.S.D.A. marketings number.

USfeed = The U.S.D.A. total onfeed # for the first of the month.

USmark = The U.S.D.A. marketings # for the previous month.

USplace = The U.S.D.A. placements # for the previous month.

Feeddiff = The forecast error for the average onfeed estimate.

Markdiff = The forecast error for the average marketings estimate.

Placdiff = The forecast error for the average placements estimate.

A = Feeddiff**2; B = Markdiff**2; C = Placdiff**2

Regression equations modelling price changes as a function of lagged prices to determine the best price to include as a lag in other models.

Table A-1

Regression Model	Parameter Estimate	Standard Error	T for Ho Param.=0	Prob > T
Fu1Dif1 = One0Bef	-0.01129	0.012018	-0.0939	0.3497
Fu1Dif1 = One1Bef	-0.01449	0.011895	-1.2180	0.2260
Fu1Dif1 = One2Bef	-0.01170	0.011778	-0.9940	0.3227
Fu2Dif1 = Two0Bef	-0.01548	0.012405	-1.2480	0.2148
Fu2Dif1 = Two1Bef	-0.01735	0.012570	-1.3800	0.1705
Fu2Dif1 = Two2Bef	-0.01475	0.012323	-1.1970	0.2339
Fu3Dif1 = Thr0Bef	-0.01931	0.011490	-1.681	0.0958
Fu3Dif1 = Thr1Bef	-0.02038	0.011618	-1.754	0.0824
Fu3Dif1 = Thr2Bef	-0.01794	0.011468	-1.565	0.1207
Fu1Dif2 = One0Bef	-0.01413	0.015994	-0.884	0.3788
Fu1Dif2 = One1Bef	-0.01582	0.016016	-0.988	0.3255
Fu1Dif2 = One2Bef	-0.01490	0.015686	-0.950	0.3442
Fu2Dif2 = Two0Bef	-0.02690	0.016735	-1.608	0.1109
Fu2Dif2 = Two1Bef	-0.02772	0.017041	-1.627	0.1069
Fu2Dif2 = Two2Bef	-0.02713	0.016641	-1.631	0.1060
Fu3Dif2 = Thr0Bef	-0.02178	0.014713	-1.481	0.1416
Fu3Dif2 = Thr1Bef	-0.02219	0.014942	-1.485	0.1405
Fu3Dif2 = Thr2Bef	-0.02157	0.014677	-1.470	0.1445

Regression equations modelling price changes as a function of the three average estimates and the three U.S.D.A. numbers, not included in Table 6.

Table A-2

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
FulDif2 =	Market	-0.06117	-1.440	0.1529
	Onfeed	0.10005	2.013	0.0468
	Place	0.05425	1.762	0.0811
	USmark	0.03347	0.882	0.3798
	USfeed	-0.09217	-1.934	0.0559
	USplace	-0.04231	-1.924	0.0572

Model Statistics: R**2	F-Value	Prob > F	Durbin Watson
0.1198	3.427	0.004	2.089

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
FulDif3 =	Market	-0.04976	-0.965	0.3369
	Onfeed	0.09704	1.657	0.1008
	Place	0.04545	1.243	0.2168
	USmark	0.01381	0.306	0.7600
	USfeed	-0.07572	-1.352	0.1794
	USplace	-0.03658	-1.408	0.1621

Model Statistics: R**2	F-Value	Prob > F	Durbin Watson
0.0538	1.994	0.0736	2.127

Table A-2 cont.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif2 =	Market	-0.07034	-1.665	0.0990
	Onfeed	0.10566	2.145	0.0344
	Place	0.09671	3.143	0.0022
	USmark	0.05289	1.410	0.1618
	USfeed	-0.11380	-2.414	0.0176
	USplace	-0.06200	-2.389	0.0055

Model Statistics: R**2	F-Value	Prob > F	Durbin Watson
0.2149	5.791	0.0001	2.107

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif3 =	Market	5.09679	-1.956	0.0533
	Onfeed	0.09926	1.775	0.0790
	Place	0.08473	2.414	0.0176
	USmark	0.06493	1.511	0.1339
	USfeed	-0.09100	-1.704	0.0915
	USplace	-0.05251	-2.114	0.0370

Model Statistics: R**2	F-Value	Prob > F	Durbin Watson
0.1423	3.904	0.0015	2.235

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif2 =	Market	-0.04968	-1.390	0.1677
	Onfeed	0.06656	1.588	0.1154
	Place	0.10347	3.979	0.0001
	USmark	0.04262	1.334	0.1852
	USfeed	-0.07352	-1.831	0.0701
	USplace	-0.06698	-3.613	0.0005

Model Statistics: R**2	F-Value	Prob > F	Durbin Watson
0.2429	6.669	0.0001	2.087

Table A-2 cont.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif3 =	Market	-0.07182	-1.725	0.0876
	Onfeed	0.04119	0.871	0.3858
	Place	0.08842	2.995	0.0035
	USmark	0.05848	1.608	0.1110
	USfeed	-0.04314	-0.095	0.3423
	USplace	-0.05571	-2.610	0.0104

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.132	3.686	0.0024	2.181

Regression equations modelling price changes as a function of the three average estimates and the three U.S.D.A. numbers plus a lagged futures price.

Table A-3

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
FulDif1 =	Market	-0.06202	-1.984	0.0502
	Onfeed	0.08258	2.286	0.0245
	Place	0.04916	2.146	0.0344
	USmark	0.04384	1.586	0.1161
	USfeed	-0.08450	-2.422	0.0173
	USplace	-0.02575	-1.567	0.1206
	OnelBef	-0.00861	-0.694	0.4894

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.1669	3.89	0.001	1.939

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
FulDif2 =	Market	-0.06603	-1.532	0.1288
	Onfeed	0.09577	1.914	0.0586
	Place	0.05142	1.659	0.1003
	USmark	0.02950	0.772	0.4420
	USfeed	-0.08551	-1.773	0.0794
	USplace	-0.04216	-1.911	0.0589
	OnelBef	-0.01746	-1.020	0.3103

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.1188	3.041	0.0062	2.033

Table A-3 cont.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu1Dif3 =	Market	-0.05824	-1.121	0.2651
	Onfeed	0.08933	1.524	0.1308
	Place	0.04098	1.121	0.2651
	USmark	0.00700	0.155	0.8770
	USfeed	-0.06417	-1.139	0.2575
	USplace	-0.03652	-1.411	0.1615
	OnelBef	-0.03024	-1.512	0.1338

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.0648	2.029	0.0586	2.009

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif1 =	Market	-0.06660	-2.204	0.0299
	Onfeed	0.09137	2.648	0.0095
	Place	0.07527	3.389	0.0010
	USmark	0.06090	2.298	0.0238
	USfeed	-0.10388	-3.122	0.0024
	USplace	-0.03909	-2.474	0.0151
	TwolBef	-0.00367	-0.29	0.7722

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.2839	6.721	0.0001	1.866

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif2 =	Market	-0.08035	-1.876	0.0637
	Onfeed	0.10401	2.111	0.0374
	Place	0.09011	2.892	0.0047
	USmark	0.04845	1.285	0.2018
	USfeed	-0.10778	-2.275	0.0251
	USplace	-0.06137	-2.809	0.0060
	TwolBef	-0.02512	-1.394	0.1664

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.2224	5.25	0.0001	2.034

Table A-3 cont.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif3 =	Market	-0.11374	-2.307	0.0232
	Onfeed	0.09555	1.735	0.0859
	Place	0.07388	2.116	0.0369
	USmark	0.05657	1.330	0.1866
	USfeed	-0.07982	-1.511	0.1340
	USplace	-0.05177	-2.118	0.0368
	TwolBef	-0.04455	-2.218	0.0289

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.1762	4.178	0.0005	2.124

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif1 =	Market	-0.04734	-1.759	0.0817
	Onfeed	0.06923	2.252	0.0266
	Place	0.08177	4.180	0.0001
	USmark	0.05127	2.162	0.0331
	USfeed	-0.08118	-2.739	0.0074
	USplace	-0.04746	-3.379	0.0011
	TwolBef	-0.00824	-0.707	0.4813

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.3252	8.023	0.0001	1.884

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif2 =	Market	-0.05780	-1.583	0.1166
	Onfeed	0.06727	1.602	0.1124
	Place	0.09975	3.805	0.0002
	USmark	0.03774	1.171	0.2446
	USfeed	-0.06948	-1.721	0.0881
	USplace	-0.06763	-3.640	0.0040
	TwolBef	-0.01996	-1.258	0.2114

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.2467	5.914	0.0001	2.018

Table A-3 cont.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif3 =	Market	-0.08762	-2.096	0.0387
	Onfeed	0.04209	0.901	0.3696
	Place	0.08199	2.798	0.0062
	USmark	0.04958	1.370	0.1738
	USfeed	-0.03538	-0.790	0.4314
	USplace	-0.05619	-2.713	0.0079
	TwolBef	-0.03756	-2.131	0.0356

Model Statistics:	R**2	F-Value	Prob > F	Durbin Watson
	0.1617	3.893	0.0009	2.079

Regression equations modelling price changes as a function of the three forecast errors and the forecast errors squared.

Table A-4

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif1 =	Feeddiff	-0.23843	-2.786	0.0065
	A	0.00856	1.396	0.1660
	Markdiff	-0.11448	-1.418	0.1594
	B	0.03139	2.049	0.0433
	Placdiff	-0.03906	-1.037	0.3024
	C	0.00314	1.228	0.2225

Model Statistics:	R**2	F-Value	Prob > F
	0.2728	7.253	0.0001

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif2 =	Feeddiff	-0.24784	-2.057	0.0425
	A	0.00962	1.114	0.2683
	Markdiff	-0.02646	-0.233	0.8164
	B	0.01329	0.616	0.5393
	Placdiff	-0.09013	-1.700	0.0925
	C	0.00510	1.414	0.1608

Model Statistics:	R**2	F-Value	Prob > F
	0.2256	5.857	0.0001

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif3 =	Feeddiff	-0.23724	-1.660	0.1003
	A	0.01037	1.012	0.3143
	Markdiff	0.04634	0.344	0.7318
	B	-0.00120	-0.047	0.9624
	Placdiff	-0.05079	-0.808	0.4213
	C	0.00232	0.543	0.5884

Model Statistics:	R**2	F-Value	Prob > F
	0.1128	3.119	0.0079

Table A-4 cont.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif1 =	Feeddiff	-0.02954	-0.560	0.5767
	A	0.00200	0.531	0.5969
	Markdiff	-0.04198	-0.842	0.4018
	B	0.00752	0.792	0.4303
	Placdiff	0.00433	0.187	0.8517
	C	0.00030	0.193	0.8472

Model Statistics:	R**2	F-Value	Prob > F
	-0.0464	0.232	0.9654

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif2 =	Feeddiff	-0.01298	-1.294	0.1986
	A	0.00355	0.494	0.6223
	Markdiff	-0.03157	-0.333	0.7399
	B	0.01622	0.897	0.3717
	Placdiff	-0.11419	-2.597	0.0109
	C	0.00627	2.116	0.0369

Model Statistics:	R**2	F-Value	Prob > F
	0.2363	6.363	0.0001

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif3 =	Feeddiff	-0.07052	-0.592	0.5554
	A	0.00147	0.172	0.8636
	Markdiff	0.04266	0.379	0.7058
	B	0.00323	0.151	0.8806
	Placdiff	-0.08405	-1.609	0.1108
	C	0.00425	1.207	0.2302

Model Statistics:	R**2	F-Value	Prob > F
	0.0832	2.572	0.0234

Regression equations modelling price changes as a function of the forecast errors and a lagged futures price.

Table A-5

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
FulDif1 =	Feeddiff	-0.04547	-1.243	0.2168
	Placdiff	-0.02184	-1.362	0.1763
	Markdiff	-0.00199	-0.064	0.9488
	OnelBef	-0.02130	-1.411	0.1616

Model Statistics:	R**2	F-Value	Prob > F
	0.0312	1.796	0.136

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
FulDif2 =	Feeddiff	-0.06464	-1.473	0.1440
	Placdiff	-0.04203	-2.185	0.0313
	Markdiff	-0.01550	-0.417	0.6779
	OnelBef	-0.02080	-1.148	0.2537

Model Statistics:	R**2	F-Value	Prob > F
	0.0648	2.714	0.0344

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
FulDif3 =	Feeddiff	-0.04048	-0.839	0.4033
	Placdiff	-0.04561	-2.157	0.0335
	Markdiff	-0.03363	-0.822	0.4130
	OnelBef	-0.03426	-1.721	0.0886

Model Statistics:	R**2	F-Value	Prob > F
	0.056	2.467	0.05

Table A-5 cont.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif1 =	Feeddiff	-0.06900	-1.997	0.0486
	Placdiff	-0.03155	-2.085	0.0397
	Markdiff	0.00422	0.144	0.8859
	TwolBef	-0.00981	-0.676	0.5009

Model Statistics:	R**2	F-Value	Prob > F
	0.0781	3.117	0.0186

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif2 =	Feeddiff	-0.08895	-2.070	0.0412
	Placdiff	-0.05327	-2.829	0.0057
	Markdiff	-0.01436	-0.393	0.6949
	TwolBef	-0.01863	-1.031	0.3052

Model Statistics:	R**2	F-Value	Prob > F
	0.118	4.346	0.0028

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu2Dif3 =	Feeddiff	-0.05780	-1.220	0.2253
	Placdiff	-0.04917	-2.370	0.0198
	Markdiff	-0.01030	-0.256	0.7984
	TwolBef	-0.03844	-1.930	0.0565

Model Statistics:	R**2	F-Value	Prob > F
	0.0847	3.314	0.0137

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif1 =	Feeddiff	-0.07154	-2.399	0.0184
	Placdiff	-0.03515	-2.687	0.0085
	Markdiff	0.00794	0.312	0.7558
	Thr1Bef	-0.01424	-1.108	0.2705

Model Statistics:	R**2	F-Value	Prob > F
	0.1402	5.075	0.0009

Table A-5 cont.

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif2 =	Feeddiff	-0.08004	-2.214	0.0292
	Placdiff	-0.05043	-3.180	0.0020
	Markdiff	-0.01355	-0.439	0.6617
	Thr1Bef	-0.01707	-1.096	0.2758

Model Statistics:	R**2	F-Value	Prob > F
	0.1438	5.2	0.0008

Regression Model		Parameter Estimate	T for Ho Param.=0	Prob > T
Fu3Dif3 =	Feeddiff	-0.04497	-1.124	0.2636
	Placdiff	-0.04243	-2.419	0.0175
	Markdiff	-0.00889	-0.260	0.7951
	Thr1Bef	-0.03128	-1.850	0.0673

Model Statistics:	R**2	F-Value	Prob > F
	0.0787	3.136	0.018

THE IMPACT OF PUBLISHED EXPECTATIONS OF U.S.D.A. CATTLE ON FEED REPORT NUMBERS ON LIVE CATTLE FUTURES MARKETS

by

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B.S., Kansas State University, 1986

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Agricultural Economics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1987

This research analyzed four objectives involving cattle futures volatility surrounding the release of U.S.D.A. Cattle on Feed Reports and its relationship with market expectations. Specifically, the role of published pre-release estimates on the Commodity News Service wire, were examined with respect to price changes following the reports. The research examined the relationship of these estimates and price changes following Cattle on Feed Reports to determine if the estimates were partially and/or fully rational. The three estimates analyzed were the total onfeed, the placements, and the marketings figures.

Data included published estimates, U.S.D.A. numbers, and cattle futures prices for the period February 1977 - December 1986. A complete data set with monthly and quarterly data interspersed, as well as seperate data sets with only monthly and quarterly numbers, were analyzed.

The basic statistical methodology involved the use of a regression equation modelling price changes as a function of the three U.S.D.A. numbers and the three average analysts' estimates. The model was not found to be statistically adequate at predicting future price changes, but it did yield other significant information.

The results indicated that the onfeed and marketings estimates were both unbiased and fully rational measures

of the U.S.D.A. numbers, as well as accurate measures of market expectations. However, the placements estimate was found to be a biased estimate of the U.S.D.A. corresponding figure and was not an accurate measure of pre-release expectations.

The results also indicated that recent claims among cattle producer organizations that the pre-release expectations increase volatility in the cattle futures markets is probably unwarranted. The published estimates provide information to the market of what true expectations of Cattle on Feed numbers are before the Report release, in two of three cases. This information can be used by producers in their cattle hedging programs.